DENVER WATER

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December 12, 2018

PROFESSIONAL SERVICES
REQUEST FOR PROPOSALS

Gross Reservoir Expansion Project
Tree Removal Plan

Request for Proposals (RFP)

The Gross Reservoir Expansion (GRE) Project (also known as the Moffat Collection System Project) is a water supply project proposed by the Board of Water Commissioners for the City and County of Denver (Denver Water). The GRE Project will expand the capacity of the existing reservoir and require the clearing of over 400 acres of forested land surrounding the reservoir. Denver Water is soliciting proposals from qualified firms to prepare a **Tree Removal Plan** (Plan) for the GRE Project that will accomplish the following:

- Evaluate the most cost-effective and efficient tree removal and disposal options
- Develop cost estimates for each option
- Identify road construction and/or improvements to haul product on-site and transport off-site
- Recommend a preferred method in consultation with the U.S. Forest Service, Colorado State Forest Service, Boulder County, Jefferson County and Denver Water

The proposed scope of work and requirements for preparing a complete proposal are presented herein.

Project Description and Background

Gross Reservoir is owned and operated by Denver Water as part of its raw water supply system. The dam and reservoir are located on South Boulder Creek in Boulder County, CO approximately 6 miles southwest of the city of Boulder. The dam is located in Section 21 within Township 1 South, Range 71 West, Section 20 of the Eldorado Springs, Colorado USGS 7.5-minute topographic quadrangle. Water stored in Gross Reservoir is from South Boulder Creek and the Williams Fork and Fraser rivers diverted from the West Slope through the Moffat Tunnel. Expanding Gross Reservoir is a critical component of Denver Water's strategy to ensure the quality, reliability and resiliency of its collection system that provides water to more than 1.4 million customers in its service area.

The GRE Project involves raising the existing concrete gravity arch dam by 131 feet from 340 to 471 feet high. The reservoir storage capacity will be expanded by 77,000 AF from 41,811 to 118,811 AF. This includes 72,000 AF for Denver Water's storage needs and 5,000 AF for a dedicated "environmental pool" to store water owned by the cities of Boulder and Lafayette to be used to improve low flows in South Boulder Creek. The surface area of the reservoir will be expanded by approximately 400 acres and the reservoir shoreline will increase by approximately 3 miles.

Denver Water received a Section 404 permit for the GRE Project from the U.S. Army Corps of Engineers in September 2017 and is awaiting an amendment to its hydropower license from the Federal Energy Regulatory Commission (FERC). The FERC Order is expected in early 2019. As part of the permitting process, Denver Water hired Land Stewardship Associates, LLC (LSA)

to prepare a “Gross Reservoir - Tree Removal Plan for Pool Enlargement”, which was prepared in February 2008, updated in July 2008 and further supplemented in October 2008. Refer to **Appendix A** for a copy of the report. Throughout the 15^{+}-year permitting process for the GRE Project, Denver Water has received and continues to receive numerous comments and concerns about tree removal, transportation impacts, disposal methods, and environmental impacts (noise, air quality, soil erosion, etc). The Tree Removal Plan will enable Denver Water to address these concerns and provide decision-makers with current options.

Based on the 2008 LSA reports, the existing information about the inundation area to be cleared is the following. The U.S. Forest Service (USFS) will be conducting a timber cruise in 2020 to update the biomass estimate and determine merchantable timber. The cruise results will not be available to Denver Water in time for this Plan update; therefore, the information presented in the 2008 LSA reports should be used for the new Plan at this point in time.

- **Area to be inundated**: approximately 424 acres: ~154 acres of Denver Water property and ~270 acres of National Forest System (NFS) land between elevations 7,282 feet (current high water) and 7,410 feet (4 feet above the new high-water level of the expanded reservoir). The actual area to be cleared will be between 7,282 and 7,406 feet. However, for this RFP it is appropriate to use the information in the 2008 LSA reports. Refer to the figure in **Appendix B**.
- **Tree density:** 150 to 1,800 trees/acre. Most of the trees are 20 to 50 feet tall and vary in diameter at breast height (dbh) from 4 to 14 inches. Thirty-five (35) unique stands of trees were identified along the shoreline. Shoreline vegetation includes predominately ponderosa pine and Douglas fir, with some Rocky Mountain juniper with inclusions of grass/shrub savannah.
- **Forest biomass:** approximately 50,000 tons of forest residue. Refer to Appendix IV in LSA 2008 for residue volume calculations. This biomass estimate is for the inundation area between elevations 7,282 and 7,410 feet. For purposes of this RFP and the new Plan, the Consultant should assume these quantities for the inundation area, but will be asked to evaluate the reasonableness of the estimate.

Project Objectives

The overall objective is to prepare a new Tree Removal Plan that recommends the most cost-effective and efficient tree removal and disposal options, maximizes product utilization, minimizes hauling traffic, and minimizes nuisance factors such as noise, light, and odor.

A successful plan will address the following specific objectives:

- Provide a new tree removal plan for the reservoir inundation area that updates the 2008 LSA reports and incorporates current knowledge and best industry practices for tree removal and disposal options taking into consideration the topographic and access constraints. The desired condition is to remove all trees, shrubs and associated debris within the inundation area to minimize future floating debris when the expanded reservoir fills.
- Provide an estimate of the number of truck trips for the various options for timber waste and merchantable timber removal and the likely path of egress from the site.
- Evaluate the advantages and disadvantages, and estimated costs of each option, and recommend the preferred methods.
- Identify locations for new logging roads or improvements to existing roads needed to implement the preferred methods. New access roads should be located below the new

high-water level of 7,406 feet, if possible. Propose locations for staging and disposal of material.

- Prepare conceptual design drawings of roads associated with the preferred alternative.

Section 1 – Administrative Requirements

1.1 Consultant Scope of Services

Consultant shall provide project management on a day-to-day basis to administer interrelated activities, manage personnel and resources, monitor schedules and budgets, coordinate with Denver Water and other appropriate parties, and prepare and distribute project updates.

1.2 Consultant Qualifications

Denver Water is seeking consultants who have experience in describing, evaluating, and recommending methods for stand treatment and disposal of material. Personnel qualifications will be evaluated as part of the Proposal evaluation process.

1.3 Denver Water Responsibility

Denver Water will provide to the Consultant available relevant information to aid in the Plan development and road design process. This includes but is not limited to:

- Land Stewardship Associates, LLC (LSA), 2008, Gross Reservoir - Tree Removal Plan for Pool Enlargement (refer to Appendix A of this RFP)
- Map of delineated wetlands and sensitive species habitat within the inundation area
- Traffic Control Plan for the Gross Reservoir Expansion Project
- Permission to enter the Miramonte property, NFS land and Denver Water property
- Review comments on draft documents within agreed upon schedules
- Coordination with the agencies, including USFS, Colorado State Forest Service (CSFS), Boulder County and Jefferson County
- 2015 LIDAR mapping of the reservoir shoreline ground surface

1.4 Project Contact Information

Any requests for clarification or additional information regarding submission of this RFP shall be submitted in writing via e-mail to Travis Bray (travis.bray@denverwater.org), or during the Pre-Proposal Meeting that will be held at Gross Reservoir. Written requests must be received no later than 4:00 pm, local time, Friday, **January 11, 2019**.

All questions and associated answers will be issued by Travis Bray via email to attendees at the Pre-Proposal Meeting by **January 18, 2019**.

1.5 Mandatory Pre-Proposal Meeting

A mandatory, informational Pre-Proposal meeting will be held on **January 8, 2019** at the Gross Dam caretakers' headquarters. In the event of inclement weather, the backup date will be **January 10, 2019**. The meeting will take approximately 2 hours. Changes to the Pre-Proposal Meeting date or time will be posted to the Gross Reservoir Expansion Project website: https://grossreservoir.org.

Driving directions to Gross Dam Headquarters (3635 Gross Dam Road): from the intersection of CO Highway 93 and 72 near Rocky Flats head West on CO 72 to Gross Dam Road

(approximately 10 miles). Turn right on Gross Dam Road and go for approximately 4 miles to Gross Dam Headquarters (3635 Gross Dam Road).

1.5 Proposal Submission

Proposals shall be in the format noted. Denver Water reserves the right to disqualify any response submitted incorrectly. Consultants are requested to submit:

- Four (4) hard copies of the Consultant's proposal
- One (1) electronic copy of the proposal provided as a pdf on DVD or flash drive
- In addition, submit one hardcopy of the Consultant's Proposal with intellectual or proprietary property redacted.

Proposals are due no later than 4 PM, local time, January 25, 2019. Late proposals will not be reviewed or scored.

Proposals shall be addressed as follows:

Project Title:	Gross Reservoir Expansion Project RFP for Tree Removal Plan
Attention:	Travis Bray
Address:	Denver Water, Administration Building 1600 West 12th Avenue Denver, CO 80204-3412

Submittal Instructions:

a. Proposals may be either mailed or hand-delivered. If the proposal is sent by mail, please allow extra time for delivery before the deadline. (Note: No e-mailed or faxed proposals will be accepted.)

b. Proposals shall contain the signature of a duly authorized officer or agent of the Respondent's company empowered with the right to contractually bind the Respondent.

c. Proposal shall be sealed and addressed as stated previously to ensure confidentiality of the information prior to the submission date and time. Denver Water is not responsible for premature opening of proposals improperly labeled.

d. Proposals become the property of Denver Water upon receipt. The content of proposals will be kept confidential until an award is made, after which the content will no longer be kept confidential, except as provided herein.

e. Proposals may be withdrawn or modified in writing prior to the proposal submission deadline. Proposals that are modified shall be sealed and resubmitted according to the aforementioned instructions prior to the proposal submission deadline.

1.3 Proposal Requirements

The proposal must contain all the following information, in the same sequence as presented below. The proposal shall outline the Consultant's scope of services, which at a minimum must include the criteria set forth within this Request for Proposal, and the Consultant's approach to administer and complete the project. A detailed project approach will assist Denver Water in understanding the Consultant's comprehension of the project and the opportunities and constraints that a project of this complexity may contain. Proposals must be limited to 12 pages, not including resumes (double-sided counts as 2 pages). A MWBE goal of 0% has been set for

this Work. More information on Denver Water's MWBE Program can be found online at: http://www.denverwater.org/

a. **Cover Letter** - Include a cover letter that introduces your company, summarizes your firm's qualifications, and provides the principal contact information for this RFP including name, address, email, and telephone number.

b. **Approach to Scope of Services** - Provide a description of your approach to accomplishing the Scope of Services described in **Section 3** of this RFP. Provide a detailed schedule of work by task with any deviations from the tentative schedule presented in **Section 2**.

c. **Budget or Cost Estimate** - Provide an itemized budget listed out by task, including:

   - A manpower labor estimate via a detailed breakdown by labor type/hours
   - A valid 2019 labor rate sheet including how indirect costs will be invoiced. Consultants and Contractors that are currently on Denver Water's General Engineering Services (GES) Task Order List shall use the same labor rates as were approved for the GES Contract.

d. **Key Staff and Previous Experience on Similar Projects** - Provide a description of work previously completed similar in nature and complexity to the Tree Removal Plan. Provide a list of the key individuals who will work on this project along with resumes of their relevant experience. All key personnel proposed for the project must remain available for the entirety of the project; a change of project personnel will only be permitted in extreme circumstances and may be subject to a monetary penalty.

e. **Conflict of Interest Statement** - Provide a written statement regarding the Consultant's eligibility to perform the work without a conflict of interest.

1.4 Award of Contract

Agreements may be negotiated with Respondents whose proposal is determined to be most responsive to Denver Water's needs and most advantageous to Denver Water, considering the factors based on the criteria described in **Section 4**, all as solely determined by Denver Water. Award of a Professional Services Agreement may be made after proposals are received and without interviews. Therefore, proposals shall be reviewed on the qualifications, technical experience, cost, and proposed financial terms as identified in Section 4.

Once a Consultant is selected, the final scope of work will be agreed upon between the selected firm and Denver Water and contained in a Professional Services Agreement. Denver Water reserves the right to extend the Agreement, based on the Consultant's performance, with future tasks negotiated as the project progresses.

1.5 Respondent Responsible For Proposal Costs

Denver Water is not liable for any cost incurred by any Respondent associated with the preparation of a proposal, attendance at the Pre-Proposal Meeting, attendance at an interview (if needed) or the negotiation of an Agreement for services prior to the issuance of such Agreement. Proposal information becomes property of Denver Water.

1.6 Binding Proposal

Respondents are advised that proposals shall be binding upon the Respondent for sixty (60) days from the proposal due date. A Respondent may withdraw or modify their

proposal any time prior to the proposal due date by a written request, signed in the same manner and by the same person who signed the proposal.

1.7 Notification

Each Respondent submitting a proposal in response to this RFP will be notified in writing as to acceptance or rejection of their proposal. Denver Water plans to release such letters within two weeks of the proposal submittal date. Denver Water may delay this action if it is deemed to be in the best interest of Denver Water.

1.8 Right to Reject Proposals and Negotiation

Denver Water reserves the right to reject any and all proposals and to waive any formality in proposals received, to accept or reject any or all the items in the proposal, if it is deemed in Denver Water's best interest. Denver Water reserves the right to negotiate any and all elements of the proposal, if such action is deemed to be in the best interest of Denver Water.

1.9 Proprietary or Confidential Information

Respondents acknowledge that Denver Water may be required to disclose any or all the documents submitted with a Response, pursuant to the Colorado Open Records Act, C.R.S 24-72-200.1, et seq. Under C.R.S § 24-72-204(3) (a) (IV), Denver Water may deny inspection of any confidential commercial or financial information furnished to Denver Water by an outside party. Therefore, a Respondent must clearly designate any documents submitted with its Proposal that the Respondent deems proprietary or confidential, to aid Denver Water in determining what must be disclosed in response to a request for documents under the Colorado Open Records Act.

The Respondent's designation of material to be redacted must be reasonable or it will not be honored. For example, a Respondent may not designate the entire Proposal to be confidential and proprietary.

1.10 CPCS and CPPM

Respondents are recommended to access and become familiar with a copy of the most recent version of Denver Water's Capital Projects Construction Standards, 3rd Edition (CPCS) and Capital Projects Procedures Manual (CPPM) at no cost to Denver Water. Project execution shall follow the CPPM, which can be found at http://www.denverwater.org..

Section 2 – Project Schedule

The anticipated Project Milestone Schedule is summarized below:

12/12/2018	Request for Proposal advertised through Bids and Contracts on www.denverwater.org
1/8/2019	Mandatory Pre-Proposal Meeting at Gross Reservoir
1/11/2019	Final Written Questions Due
1/18/2019	Responses to Questions Issued by Denver Water
1/25/2019	Proposals Due
2/7/2019	Consultant Interviews (if needed)
2/13/2019	Selected Consultant Recommendation to the Board

2/15/2019	Notice to Proceed Issued to Selected Consultant
Feb-Apr 2019	Report Preparation and Reviews
mid-May 2019	Meeting with USFS, CSFS, Boulder County and Jefferson County to present findings and identify the preferred option(s)
mid-June 2019	Preparation of conceptual road designs for preferred option(s)
mid-July 2019	Final Report submitted to Denver Water

Section 3 – Scope of Services

The selected Consultant and Denver Water will enter into a Professional Services Agreement based on project milestones and performance. The proposal should describe the approach and assumptions made to accomplishing the following Scope of Services. Reports and figures greater than 30 MB shall be provided by the Consultant in electronic media on Windows compatible Hi-Speed USB Flash Drives and in quality hard copy media.

Phase 1 – Project Management

Project Management includes the following activities:

- General Project Management
- Project Controls and Reporting
- Project Meetings

Task 1.1: General Project Management

Time for this task is allocated to the Consultant Project Manager to oversee and administer the project.

Deliverables:

- *Cost Loaded Schedule/Work Breakdown Structure Time Allocation.*

Task 1.2: Project Controls and Reporting

Monthly invoices will be prepared and submitted to Denver Water in an approved format. Invoices will include the following broken down by task, Prime Consultant, and Subconsultants:

- Total contract amount
- Detailed charges for the current invoice period
- Total charges to date
- Earned value analysis and graph
- Previous billings
- Outstanding balance
- Current amount remaining
- Total amount due

Consultant shall be responsible for management of the Consultant and Subconsultant Project Team's overall project controls, actively coordinating with Denver Water's Project Manager to manage:

- Project costs
- Project schedule
- Document control

Monthly project status reports shall be prepared and submitted to Denver Water, along with the monthly invoices. These reports will include:

- Summary of services completed since the previous report
- Current Project Schedule and budget status
- Project issues and potential change logs
- Milestones and/or deliverables scheduled in the coming month

This task also includes periodic project review by Consultant management to assure that the project is meeting Denver Water's critical success factors, is on schedule and within budget.

Deliverables:

- *Monthly Invoices*
- *Monthly Project Status Reports*

Task 1.3: Project Meetings

Project meetings include the key Project Team stakeholders and, as needed for the current topic, project stakeholders.

- **Project Kickoff Meeting.** Following issuance of the Notice to Proceed, organize and participate in a project kickoff meeting with pertinent Denver Water staff to discuss the scope and schedule of the project.
- **Project Review Meetings.** During the development of the final draft plan, schedule and participate in review meetings with pertinent Denver Water staff to discuss preliminary findings, issues, and comments on draft versions of the plan. Assume up to 5 meetings.
- **Agency Review Meetings.** Prepare for and participate in review meetings with Denver Water and agency staff potentially from the USFS, CSFS, Boulder County and Jefferson County. Denver Water will coordinate directly with the agencies as needed. Assume 2 meetings.

Deliverables:

- *Agendas for each meeting*
- *Meeting notes (draft and final) recording the issues discussed, decisions reached and action items*
- *Ongoing log of all decisions and conflict resolutions*

Phase 2 – Plan Development

Prepare a Tree Removal Plan that describes the quantities and alternative methods that could be used to harvest and dispose of timber, including the following activities:

- Identification and description of all possible harvest and disposal methods
- Recommended treatment for each stand and disposal method
- Explanation of rationale for not selecting a harvest or disposal method
- Identification of roads and other areas key to the Plan

Task 2.1: Site Reconnaissance

Perform site reconnaissance to assess the reasonableness of the biomass assumptions, methods, roads, etc. presented in the LSA report and develop updated approaches to tree

removal and disposal. Proposed routes for trucking of materials shall be surveyed and identified for more detailed design evaluation based on the preferred option.

- Allow for at least 2 weeks of site reconnaissance depending on the season that the work is performed.
- Perform physical ground surveys of features not sufficiently detailed from LIDAR data in order to refine grading plans for access roads. Allow for 10 crew days of on-the-ground surveys depending on the season that the work is performed.

Deliverables:

- *Technical memorandum summarizing findings from site reconnaissance, including an opinion of reasonableness of the LSA report and uncertainties to be addressed in the selection of the final preferred option.*

Task 2.2: Draft Tree Removal Plan

Prepare a Draft Tree Removal Plan for Denver Water review. The Draft Plan should address and/or consider the following:

- **Tree Removal**: Using the best industry practices, identify and describe the different methods for stand treatment practicable for Gross Reservoir (e.g., ground based, cable system, helicopter system, hydro-ax, etc.). Recommend a preferred treatment(s) for all the stands within the Gross Reservoir inundation area to maximize product utilization and minimize traffic and environmental effects. Summarize rationale for dismissing other alternatives considered.
    - Stantec and AECOM are assisting Denver Water with the design of the Gross Reservoir Enlargement Project. Stantec and AECOM have prepared two design packages that includes vegetation and tree associated with site development (not within the inundation area). The vegetation clearing scopes of work will be provided to the Consultant and reviewed in the field during the site reconnaissance. Review and provide comments about the specifications and tree removal management alternatives recommended.
        - **Package 1 Investigative Quarry** – this work includes about 3 acres of clearing and grubbing of all vegetation (trees, shrubs, stumps, roots, brush, and other vegetation) and removal from the site.
        - **Package 2 Site Development** – this work includes about 25 acres of sufficient vegetation clearing (trees, stumps and brush) to enable construction activities and equipment mobilization.
- **Tree Disposal**: Using the best industry practices, identify and describe the different methods for disposal of material created during stand treatments (e.g., air curtain destructor, Bio-char, firewood, grinding, landfill, saw-mill, slash, etc.). Evaluate factors such as production rates and seasonal constraints for each option, and the current market options for product utilization and disposal. Recommend the preferred method(s) to maximize product utilization and minimize traffic and environmental effects. Summarize rationale for dismissing other alternatives considered.
- **Access and Road Management**: Identify and propose roads to be improved, constructed and used for tree removal activities for each option considered. New access roads should be located below the new high-water level of 7,406 feet, if possible. Propose locations for staging and disposal of material.

- Consider using barges(s) or hoist systems for removing trees and moving residue to the existing boat launch area, including need for docking (loading/unloading) facilities, haul cost of barges, and reservoir pool levels.
- Develop GIS based maps showing stands, existing roads, proposed roads, key areas for the Plan, and other pertinent Project information.

- **Cost Estimate:** Using the most recent version of LOGCOST or similar software, provide conceptual cost estimates of the recommended stand treatment applications and disposal methods.
- **Permitting and Environmental Considerations**: Evaluate permitting requirements for each tree removal and disposal option and the distinguishing opportunities to minimize traffic and environmental effects.
    - The inundation area was previously evaluated for cultural resources. Information will be shared with the selected Consultant.
    - The inundation area does contain populations of USFS sensitive plant species. Denver Water will be responsible for developing and implementing a plan to mark the populations in the field and to transplant the plants prior to any tree removal in the inundation area. This is not part of the scope of services.
    - The USFS requires that the proposed tree removal schedule consider key winter range timing for elk (December 1 through March 30) and raptor nesting seasons.
- **Schedule**: Propose a schedule for tree removal and disposal; consider phasing over multiple years, if appropriate.
- **Recommendations**: Summarize the advantages and disadvantages and costs of tree removal and disposal options considered. Summarize the recommended method(s) and the basis for the recommendation.
- **Miramonte Fuel Break**: Denver Water committed to implementing a fuel break on Miramonte's private property adjacent to Denver Water's southern property boundary. Refer to the general vicinity in figure in **Appendix B**. The approximate length of the property is 2 miles. It is assumed that this additional work would coincide with tree removal efforts in the reservoir inundation area. Recommend a preferred treatment method to thin the stand to create an effective fuel break. Denver Water will be responsible for coordinating with Miramonte and obtaining permission to access the property.

Deliverables:

- *Draft Tree Removal Plan*

Task 2.3: Final Tree Removal Plan and Agency Review

Based on review comments from Denver Water, revise the Draft Plan and prepare the Final Draft Plan for review by the USFS, CSFS, Boulder County and Jefferson County. Facilitate and participate in a meeting with the agencies to review the Draft Final Plan and a follow-up meeting to respond to comments and present the final recommendations.

Based on agency review comments and direction from Denver Water, prepare the FINAL Plan.

- **Road Design:** Provide a conceptual alignment for timber harvest haul routes and trucking ingress and egress routes to and from the site. Evaluate the maximum grades on the preferred alignments and recommend a preferred section for the roadways. Make

a preliminary assessment of drainage requirements for the proposed alignment. Provide an estimate of the number of truck trips and route for the disposal alternatives under consideration.

Deliverables:

- *Final Draft and Final Tree Removal Plan*
- *Meeting agendas and notes*
- *Road design plans*

Section 4 – Selection Criteria

Denver Water will review the Proposals and make a selection based on best value while considering the criteria listed below. Denver Water may elect to follow the proposals with a formal questionnaire and/or interview to assist with the proposal evaluation. Final selection of a Consultant will be based upon the identified selection criteria. Once a Consultant is selected, the final scope of work will be negotiated between the selected firm and Denver Water, and defined in a Professional Services Agreement.

The scale of the criteria is from 1 to 10, with 1 being a poor rating, 5 being an average rating, and 10 being an outstanding rating. All criteria will be multiplied by the associated weight to give a weighted criteria score. The weighted criteria scores will be summed for a cumulative score. The maximum possible cumulative score is 100.

Weighted Selection Criteria		
Weight	**Criteria**	**Standard**
3	**Proposed Approach and Schedule**	Does the proposal show an understanding of the project objectives and the results that are desired from the project?
5	**Firm and Key Staff Experience**	Does the firm have the appropriate capabilities to meet the demands of the project? Has the firm done previous projects of this type of scope? Do the assigned personnel have the skills and experience to provide a detailed and complete study? Does personnel have firsthand experience in this type of work?
2	**Costs and Work Hours**	Do the work hours presented accurately reflect the level of effort required to complete the project?

Appendices

A – Land Stewardship Associates, LLC (LSA), 2008, Gross Reservoir - Tree Removal Plan for Pool Enlargement, February, updated July 2008 and supplemented in October.

B – Figures

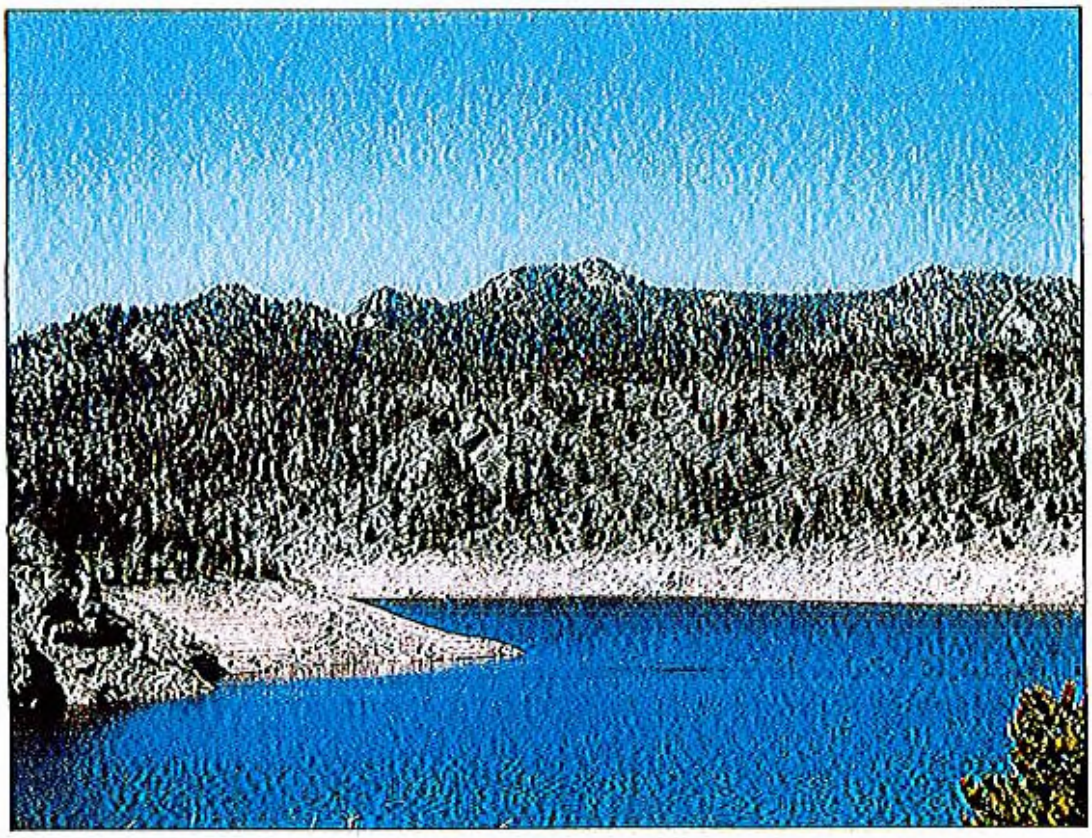
- Gross Reservoir Inundation Area Figure
- General Location of Fuel Break Activities Figure

APPENDIX A –

Land Stewardship Associates, LLC (LSA), 2008, Gross Reservoir - Tree Removal Plan for Pool Enlargement, February, updated July 2008 and supplemented in October.

GROSS RESERVOIR

TREE REMOVAL PLAN FOR POOL ENLARGEMENT



July, 2008

Prepared by Land Stewardship Associates, LLC

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Appendices

- **I Maps**
  - **Map A**: Slope, Pool Line & Stands – Gross Reservoir Area
  - **Map B**: 2005 NAIP aerial with Stands, Landings, Roads and Helispots – Gross Reservoir Area
  - Gross Reservoir Contour Map – (Fish-n-Map Co.) in report pocket
- **II References**
- **III List of Potential Operators**
- **IV Residue Volume Calculations** – On CD in report pocket
- **V LOGCOST version 8.0** – Excel Spreadsheet on CD in report pocket
- **VI Publication** – "The Use of Air Curtain Destructors for Fuel Reduction and Disposal" in report pocket

INTRODUCTION

Denver Water Department owns and operates Gross Reservoir as part of its water supply system along the Front Range of Colorado. This reservoir is located southwest of Boulder, Colorado, in the upper reaches of the South Boulder Creek.

Current plans call for increasing the size of the dam at the Gross Reservoir, thereby raising the pool at the spillway elevation from 7,282' (USGS quad maps show the current spillway pool at 7,287') to 7,400'. **To minimize problems in the future with floating debris, etc., all trees and their associated debris, e.g. tops, slash, etc., on about 430 acres along 12.5 miles of shoreline will need to be removed between the current pool elevation of 7,282' and 7,410', which is ten feet above the new pool elevation.**

Because of the topography, e.g. very steep slopes, rock outcrops, etc., several, more complex tree removal (logging) systems will need to be used and some temporary roads will need to be constructed to remove the trees. Bruce Short, of Short Forestry, LLC, assisted Land Stewardship Associates, LLC in identifying and analyzing appropriate logging systems and access options. Also, because of air quality concerns, disposal of the "residue" resulting from tree removal, both merchantable forest products and slash, becomes complex and costly.

This "Tree Removal Plan" uses data and information from the recently completed "Gross Reservoir Forest Management Plan (May 22, 2005)" to characterize the condition of the vegetation along the shoreline. It also identifies recommended tree removal systems and alternative residue removal approaches and their associated costs.

There are a few recreation developments that will need to be removed or relocated if the reservoir is expanded: a boathouse, a few picnic sites, and a boat dock. New shoreline access roads may also be planned.

DESCRIPTION OF AREA

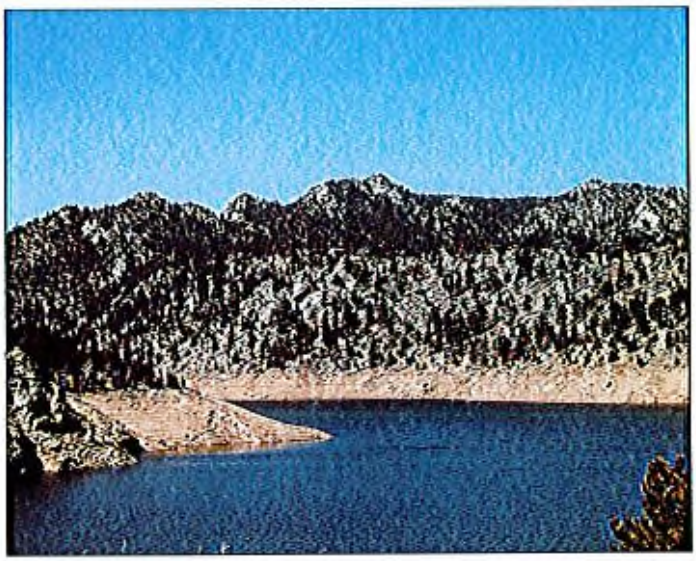
Vegetation, Topography and Surface Soil Conditions

Vegetation along the shoreline is primarily forest cover containing ponderosa pine, Douglas fir, and in spots, Rocky Mountain juniper, with inclusions of grass/shrub savannah. Most of the trees are 20 to 50 feet tall and vary in diameter at breast high (dbh) 4 to 14 inches. The density of the forest ranges from approximately 150 to 1800 trees/acre. See the "Gross Reservoir Forest Management Plan (May 22, 2005)" for a detailed description of the vegetation types.

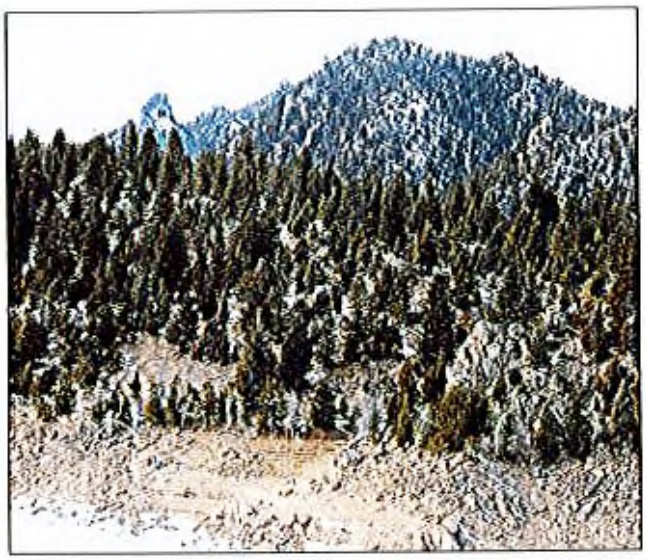
Thirty five (35) unique "stands" representing eleven (11) vegetation types (taken from the Gross Reservoir Forest Management Plan) were identified along the shoreline. **Maps A and B** in the **Appendix** identify the specific location of the stands. **Table 2** lists the stands and briefly identifies the vegetation, stems and merchantable volume for each stand. In addition, the table cross-references the vegetation types contained in the "Gross Reservoir Forest

Management Plan (May 22, 2005)" in a column labeled "Match" for a more detailed description of the vegetation.

Following are several photos displaying vegetation, topography and tree removal method or other uses.



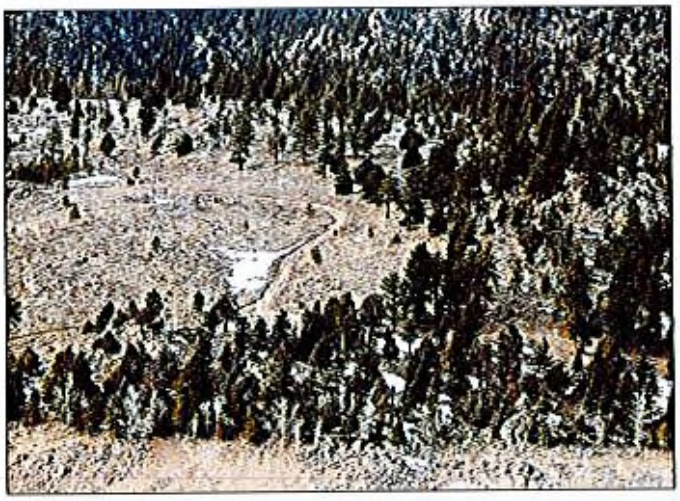
Stand 3 – Hand Fall, Grapple Skidder



Stand 22 – Feller/buncher

Stand 24 - Cable

Stand 2 – Hand Fall, Grapple Skidder



Stand 20A – Main Helipad, ACDs

Stand 7 - Helicopter

Topography. Shoreline slopes range from 20% to well over 60%. **Map A** in the **Appendix** is a USGS contour map of the area. Because 40% slope is a usual guide to help determine whether ground-based logging systems are appropriate, **Map A** identifies slopes that are over 40 percent. **Table 2** lists the average slope of each stand, whether less than 40%, over 40% or a mix of under and over 40%. A **Gross Reservoir Map**, as listed in the **Appendices** and located in the report pocked, is a topographic map of the lake bottom. The **Gross Reservoir Map** is the only contour map of the lake bottom that the authors of this report found available. Because the cartographic controls are not known, the map is included for general reference purposes only.

Surface Soil Conditions. The shoreline soils are primarily comprised of a very porous decomposed granite. There is a very high density of small to large rock outcrops on all the slopes around the reservoir. These outcrops can have a substantial impact in selecting the appropriate type of tree removal system.

Access

Points to the lakeshore are the access road from Flagstaff Road east and north of the dam, Gross Dam Road to the south of the dam through Crescent to Highway 72, and from the west across Winiger Ridge using Forest Road 359 and the 68 Road. Portions of Forest Road 359 will need to be improved in order to haul the necessary equipment for logging, residue removal, etc.

Air Quality Considerations

Approximately fifty thousand tons of forest biomass are expected to be produced during the pool expansion clearing of Gross Reservoir. Most if not all of the material currently has little, if any, commercial value. Without a market the clearing residue becomes waste. Traditionally most of the slash would have been piled and burned in place. Any easily accessible firewood would have

been sold or given away. Today, burning large quantities of forest residue, in close proximity to residential areas, is problematic in the extreme.

Colorado Department of Health, Air Quality Division and the Bolder County Department of Health are responsible for stewardship of the air shed in the Gross Reservoir area. Two factors complicate the use of open burning on the large scale required for this project. Homes with year long residents are within a half mile to a mile of the most likely burn pile locations. Night time, down canyon air drainage, will concentrate smoke along Boulder Creek and well into the Boulder Area. This project will adversely impact air quality in the region for numerous days and nights.

None of the air quality regulations can be manipulated to allow the open burning of 50,000 tons of slash anticipated from the clearing. There is a full discussion of options for dealing with project residue in the Slash Disposal section of this report.

TREE REMOVAL SYSTEMS AND COSTS

Limited road access to the lakeshore, steep slopes and large rock outcrops complicate tree removal in most areas along the lake shoreline. Ground-based systems (hand-felling with rubber-tired grapple skidding and tracked feller/buncher) and cable yarding are used where existing roads are in place or where temporary road construction is possible along the shoreline. Helicopter yarding is employed where road access is not available or possible. Hydro-axing is recommended in the upper reaches of Forsythe Canyon (Stands 1 and 3) for tree removal due to steep slopes and heavy rock.

Table 2 identifies the recommended tree removal method and estimated costs for each stand. Production and costs were modeled using **'LOGCOST 8.0'** software developed by the USDA Forest Service Pacific Northwest Region. Total costs do not include improvements to Forest Road 395 across Winiger Ridge for hauling of equipment.

The use of specific equipment manufacturers names does not represent an endorsement by Land Stewardship Associates, LLC. Instead they are included only as representative equipment with certain production and operational capabilities and were used for modeling these capabilities in **'LOGCOST 8.0'**.

It should also be noted that the recommended tree removal methods for some of the units may leave pockets and stringers of trees due to steep pitches in slope and the presence of rock barriers. Throughout the removal area it may be necessary to use combinations of special spot removal techniques. This could include hand felling and the use of grapple skidders where feller/buncher is the prescribed method. In other units it may mean hand falling and short cable skidding where a grapple skidder was prescribed. For removal of trees on small rock bluffs prescribed for cable or some other technique, the use of helicopter may be necessary.

Piece size is the primary cost factor for all the logging systems used in the project. Many of the trees are small diameter and short in height. The project entails removal of as much of every tree

as possible to reduce floating debris once the reservoir reaches its new pool elevation. Accomplishing this objective means that smaller diameter trees and tops are skidded and removed from the harvest areas, further reducing average piece size. Most material is expected to be skidded whole-tree, i.e., with tops and limbs attached.

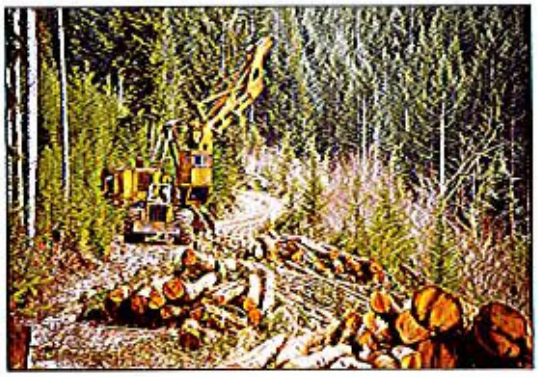
Ground-based Systems

The analysis was modeled in **'LOGCOST 8.0'** using a Cat 545B grapple skidder and hand felling with a medium-sized loader for conventional tractor operations; and a Timbco 425 EXL tilt tracked feller/buncher and JD 648 grapple skidder with medium loader for feller/buncher operations. Rubber-tired skidders were used for modeling due to their production rates, the amount of rock present in the project area and the general availability of that type of machine. Tracked skidders may be used in place of rubber-tired skidders if desired.

Example Grapple Skidder and Feller/Buncher

Cable System

The analysis uses a Linkbelt crane double drum yarder with an Eaglet Super carriage, a D6 landing cat and a medium loader.



Example High Lead Cable System

Helicopter System

The analysis was based on a light helicopter, e.g. Bell 210, with a payload of about 4800 pounds. Several of the harvest units (Stands 11A, 12, 13, 14A and 16A) use pre-bunching of the cut trees on centralized landings to increase helicopter efficiency and reduce costs. The helicopter landings are designated on **Map B** in the **Appendix** as H11, H13 and H16. The delivery point for all helicopter-yarded material is the main helipad located on the end of Winiger Ridge, accessed by Forest Road 359.

Example Bell 210 Helicopter

Example Hydro-ax

Hydro-ax

A Hydro-ax is recommended for tree removal in Stands 1 and 26 due to poor access, very low stocking levels, small trees, steep slopes and heavy rock. This machine can be worked around much of the rock and will reduce the trees and brush to small chunks which will readily decay.

Landings

Approximate landing locations for all yarding systems are shown on **Map B** in the **Appendix**. Helicopter landings are shown for Stands 11A, 12, 13, 14A and 16A. Helicopter landings H11 and H16 are located below the maximum existing pool elevation in order to utilize flatter terrain (see **Appendix** Gross Reservoir Contour map in report pocket). The remainder of the helicopter-yarded units are yarded directly from the stump to the main helipad.

Approximate landing locations for all other systems are shown on **Map B** in the **Appendix**. . Average yarding distance is generally less than 400 feet for ground-based and cable systems. Landings for Stands 2, 3, 3A, 8, 9, 10, 10A, 11, 16, and 17 are located below the existing maximum pool elevation to take advantage of flatter terrain features at the base of the tractor and feller/buncher units (see **Appendix** Gross Reservoir Contour map in report pocket). Pool elevations will need to be approximately 60 feet below maximum pool during logging operations to utilize these locations.

Temporary Roads

Temporary roads are needed to log Stands 2, 3, 3A, 8, 10, 10A, 11, 14, 15, 17, 24 and 24A and are shown on **Map B** in the **Appendix**, some of which are below existing maximum pool elevation as indicated on **Table 2.** Costs for the temporary roads are estimated at $1.00 per foot and are included in the logging system costs.

Costs

The costs between individual stands vary depending on slope, size of unit, number of stems per acre, move in/move out costs and the amount of temporary roads. Using the results of the **'LOGCOST 8.0'** analysis, the range and average costs per acre for each system are given in Table 1.

Table 1: Average Costs for Tree Removal Systems

System	Range in Costs ($/Acre)	Average Costs ($/Acre)
Cable	$4,400 - $4,700	$4,600
Feller/Buncher	$ 900 - $3,400	$1,500
Grapple Skidder	$1,000 - $6,200	$2,900
Hydro-ax	---	$750
Hellicopter	$2,000 - $13,500	$9,000

Access

From the west, across Winiger Ridge using Forest Road 359 and the 68 Road, a main helipad can be located in the open area designated as Unit 20A and adjacent open areas just north of Unit 20A. Unit 20A, and the area just north, are large enough and have favorable topography for safe helicopter operations and servicing plus enough area to locate decks of merchantable logs for resale. Chippers or Air Curtain Destructors can also be located in the Unit 20A area. As previously noted, the roads on Winiger Ridge (west side of the reservoir) will need some upgrading to bring them up to a standard needed for efficient access by helicopter refuel vehicles, timber utilization and transport of ACDs. The costs of improving the Winiger Ridge road are <u>not</u> included in this plan.

RECOMMENDED TREE REMOVAL METHODS

The following **Table 2** displays the tree removal/logging methods recommended for each of the stands identified on **Appendix I – Maps A and B**, and a number of other characteristics of the stands, including the costs of removal for each stand. Again, the costs include temporary road construction but <u>not</u> improvements to the Winiger Ridge road.

Table 2: Recommended Tree Removal Methods for Stands

Stand ID	Slope (%)	Acres*	Dominant Vegetation**	Stems (#/AC)	Merch Vol (CCF)***	Tree Removal Method	Costs ($)	Match**** (Tract #)	Comments
1	Mix	6	J, PP, DF, Shrub	248	0	Hydro-ax	3,750	109	Not loggable
2	Mix	20	DF, PP	717	246	Hand fall, grapple skidder	68,550	103A	Lndngs/Temp Rds below 7282'
26	>40	5	J, PP, DF, Shrub	248	0	Hydro-ax	3,000	109	Not loggable
25	>40	3	J, PP, DF, Shrub	717	0	none	0	103A	Cliff, hand fell a few trees
3	>40	13	PP,DF,J	307	66	Hand fall, grapple skidder	21,250	65B	Lndngs/Temp Rds below 7282'
3A	Mix	20	PP,DF,J	307	105	Hand fall, grapple skidder	28,800	65B	
4	<40	6	DF, PP, J	125	31	Hand fall, grapple skidder	6,000	54A	
24	>40	27	DF, PP	1,170	76	Cable	120,900	58B	
24A	<40	8	DF, PP	1,170	18	Hand fall, grapple skidder	15,550	58B	
5	Mix	14	DF, PP	257	170	Hand fall, grapple skidder	37,350	47A	
22	<40	15	PP	307	75	Feller/buncher	19,750	65B	
18	<40	15	Shrub, Grass				0	Savanna	No treatment
23	<40	1	PP, DF	1,350	6	Hand fall, grapple skidder	4,300	65A	
21	<40	6	PP, DF	717	70	Feller/buncher	16,800	103A	
20	<40	8	PP	307	41	Feller/buncher	10,900	65B	
19	<40	4	PP	140	53	Feller/buncher	3,750	49A	
16	<40	28	PP, DF	717	352	Hand fall, grapple skidder	102,950	103A	Lndngs/Temp Rds below 7282'
16A	Mix	15	PP, DF	717	194	Helicopter	114,600	103A	
14	<40	5	PP, DF	1,350	25	Hand fall, grapple skidder	16,100	65A	
14A	>40	10	PP, DF	1,350	45	Helicopter	77,400	65A	Lndngs/Temp Rds below 7282'
15	>40	6	PP	307	30	Hand fall, grapple skidder	7,600	65B	
6	>40	20	PP, DF	386	126	Helicopter	85,800	108	
6A	>40	6	PP, DF	386	55	Cable	30,900	108	
13	Mix	35	PP, DF, J, Shrub	717	427	Helicopter	442,600	103A	
7	>40	4	DF, PP, J	125	21	Hand fall, grapple skidder	8,000	54A	
11	Mix	15	PP, DF	282	360	Hand fall, grapple skidder	72,450	60A	Lndngs/Temp Rds below 7282'
11A	>40	7	PP, DF	282	180	Helicopter	74,350	60A	Lndngs/Temp Rds below 7282'
12	>40	17	DF, PP	248	91	Helicopter	102,200	109	
8	<40	10	PP	307	47	Feller/buncher	12,550	65B	Lndngs/Temp Rds below 7282'
10	<40	6	PP	282	159	Hand fall, grapple skidder	32,500	60A	Lndngs/Temp Rds below 7282'
10A	Mix	31	DF, PP	248	161	Hand fall, grapple skidder	43,000	109	Lndngs/Temp Rds below 7282'

Table 2: Recommended Tree Removal Methods for Stands (continued)

Stand ID	Slope (%)	Acres*	Dominant Vegetation**	Stems (#/AC)	Merch Vol (CCF)***	Tree Removal Method	Costs ($)	Match**** (Tract #)	Comments
9	<40	8	PP	218	84	Feller/buncher	8,550	107A	Lndngs/Temp Rds below 7282'
17	<40	12	PP	282	279	Hand fall, grapple skidder	68,400	60A	Lndngs/Temp Rds below 7282'
17A	>40	9	PP	282	231	Helicopter	121,500	60A	Lndngs/Temp Rds below 7282'
20A	<40	15	Grass, Rock, Shrub				0	Savanna	Helipad, ACDs, Log decks
Totals		**430**			**3,824**		**$1,782,100**		

* Includes removing trees to 7,410', or 10 feet above the new pool level of 7,400'.
** PP=ponderosa pine, DF=Douglas fir, J=Rocky Mountain juniper.
*** Merchantable Volume in Hundred Cubic Feet, assuming trees with 8" dbh and 20' height
**** Tracts from "Gross Reservoir Forest Management Plan Update", May 22, 2005.

Note: LSA considered the possibility of using a barge(s) in removing trees and moving residue. The use of barges could reduce the costs of temporary road construction, and a cable logging system could possibly be modified to pile trees and residue on a barge. However, it was concluded that the need for docking (loading/unloading) facilities, the need to maintain a full pool level, likely additional handling of the residues (loading and unloading) and the haul costs of barges to the reservoir would likely not make their use cost effective. If, however, barges will be needed during reconstruction of the dam, it may be prudent to evaluate their use at that time.

RESIDUE (PRODUCTS AND SLASH) DISPOSAL

About fifty thousand tons of forest residues will be produced during the clearing phase of pool expansion for Gross Reservoir. Some of the residue can be turned into products (sawtimber, firewood, etc.) with the remaining material being slash (unmerchantable material).

Table 3: Residue Volumes for Stands (Tons)

STANDS	ACRES	TONS/ACRE	TOTAL TONS
Stand 5	14	70.92	992.88
Stand 19	4	115.21	460.84
Stands 4 & 7	11	57.56	633.16
Stand 24 & 24A	35	206.63	7,232.05
Stands 10,10A,11,11A,17&17A	80	132.57	10,605.60
Stands 14 , 14A & 23	16	148.90	2,382.40
Stands 3,3A,8,15,20 & 22	72	106.24	7,649.28
Stands 2,13,16, 16A 21 & 25	107	159.59	17,076.13
Stand 9	8	93.94	751.52
Stand 6 & 6A	26	117.70	3,060.2
Stands 1,12 & 26	28	98.39	2,754.92
Totals	**401**		**53,598.98**

A traditional pile and burn approach to disposing of this material is no longer viable due to air quality concerns and regulations. To make the job less onerous, all opportunities to utilize some of the material need to be explored—see the discussion below in the **Potential Savings from Product Utilization** section of this report. Residue treatment options, with or without, utilization include: 1) burning in an air curtain destructor (ACD); 2) grinding whole trees and hauling to a landfill; 3) loading untreated residue into trucks and hauling to a landfill.

Each approach has its pros and cons. The following comparison of residue disposal methods is based on 2008 dollars and should be considered an approximation of the overall costs of each alternative. Perhaps the most important aspect of the analysis is the relative merits and costs of each approach.

Description of Residue Disposal Methods

Air Curtain Destructors are widely used in land clearing projects throughout the world. An ACD is a simple machine that is, in fact, a large mobile incinerator. Combustible material is loaded into the large bin and a fan blows a high pressure curtain of air across the top of the bin. The curtain recirculates combustible gases and smoke until only heat and a minimum of pollutants escape from the bin. ACDs have a 96 to 98 % reduction rate, so 2,000 pounds of slash turns into 40 to 80 pounds of ash. The ash is usually hauled to landfill.

Example Air Curtain Destructor

Operating an ACD is relatively simple. Brochures from Air Burners LLC describe the process. Slash is accumulated in large decks and a track hoe or loader with a thumb on the bucket is used to load the slash into the ACD. Each ACD will consume from 2 to 12 tons per hour depending upon the size of the unit. If one assumes a 12 ton/hour thru-put rate it will take 4,167 hours to burn all the slash anticipated from the clearing. A bank of several ACDs working simultaneously will speed the disposal process and efficiently utilize the track hoe or loader. Five ACDs working at peak efficiency can be expected to consume the slash in 833 hours. Equipment and personnel never run at peak efficiency 100% of the time. With 20% down time for maintenance and administrative gyrations the real burn time is closer to 1,000 hours for five ACDs working together. 1,000 to 2,000 tons of ash will be produced by the ACD operation and will need to be hauled to a landfill in a covered dump truck.

Grinding Whole Trees and Hauling to Landfill is another option for slash disposal. Large grinders are used to convert entire trees into rough chips. These chips can be used as fuel for steam generation, compost or simply dumped in a landfill. Currently there aren't any utilization opportunities in the steam generation or composting arena that will handle the amount of slash anticipated from this project. That leaves the landfill as the most likely contemporary solution.

Grinder operations are straight forward. Slash is decked in large piles and fed through the grinder with a track hoe or loader. The grinder blows chips into a pile or a truck and the chips are hauled to a landfill. If chips are not hauled off in a timely way, the chip pile can get large and take up a lot of space. Don Sanford from Spur Associates says they can grind 22.5 tons of dry logs in about twenty minutes. At this pace it will take 2,222 hours to grind the slash anticipated in this project. Realistically it will probably take 2,666 hours to grind the material when maintenance and administrative time is added. Obviously several grinders working at the same time will grind the material faster. Large chip vans, capable of holding

100 cubic yards of chips, will carry approximately 23 tons per load which equates to 2,174 truck loads. Grinding will produce 217,400 cubic yards of waste.

Loading and Hauling Whole Trees to a Landfill is the most primitive solution and perhaps the most expensive when haul costs and tipping fees are considered. Operationally it is the least complex approach. Trees are decked in several different locations. A track hoe with a grapple is used to load trucks. The loads are taken to a landfill. Stuffing entire trees in a truck is like trying to load cats in a bag. The loads will not be nearly as dense as chips, so many more truck loads will be required. The number of cubic yards resulting from this approach is 434,800.

Three landfills exist in the area: Denver Regional, Foothills and Front Range will accept the ash, chips or slash. Their tipping-fees range from $9.00 to $15.51 per cubic yard. Foothills Landfill is located at 8900 Hwy 93 near Golden and is closest to the project and also has the lowest tipping fee.

Table 4 summarizes the costs of disposing of residues using the above residue disposal methods.

Table 4: Residue Disposal Alternatives

ITEM	AIR CURTAIN DESTUCTOR	GRIND & LANDFILL DISPOSAL	WHOLE TREE HAUL & LANDFILL DISPOSAL
Tons of Residue	50,000	50,000	50,000
Cubic Yards to Landfill	3,613	217,400	434,800
Tipping Fees @ $9.00/yd	**$32,517**	**$1,956,600**	**$3,913,200**
Hours of operation	5,000	2,666	0
Operational costs/ton	$225	$525	0
Pre-haul costs	**$1,125,000**	**$1,399,650**	**0**
Load & haul to landfill $200/round trip	**$20,000**	**$434,800**	**$869,600**
Total Costs	**$1,177,517**	**$3,791,050**	**$4,782,800**
Cost/ton ($s)	**23.55**	**75.82**	**95.66**

Potential Savings by Product Utilization

If all of the residue generated from the shoreline clearing is disposed of by burning, it will take over four months with four Air Curtain Destructors (ACD) operating 12 hours a day, seven days a week with no breakdowns. Crews with equipment would need to be present at all times to feed the ACDs as they consume their loads. It includes over fifty thousand tons of forest residues (slash) a lot of which is tree stems over 6 inches in diameter and up to 50 feet long.

Removing merchantable material, such as logs and/or firewood, will reduce the volume of material to be treated. According to **'LOGCOST 8.0'**, generally 50% of a tree's above ground biomass is distributed in the crown (limbs, needles, and stem <4" diameter). As noted in **Table 2**, about 3,824 CCF (or about 1,800 MBF) of merchantable volume is included in the residue.

Removing and selling this material can reduce the residue volume by 25,000 tons, or 50 %, and can generate a substantial savings in residue disposal costs.

Table 5: Potential Savings by Removing Merchantable Products and/or Firewood from Residue

APPROACH TO RESIDUE DISPOSAL	AIR CURTAIN DESTRUCTOR	GRIND & LANDFILL DISPOSAL	WHOLE TREE HAUL & LANDFILL DISPOSAL
Dispose of 100% of the material removed from pool zone	$1,177,517	$3,791,050	$4,782,800
Remove merchantable sized/firewood material from residue disposal system	$588,758	1,895,525	2,391,400
Savings in Disposal from Utilization *	**$588,758**	**$1,895,525**	**$2,391,400**

* Does not include potential income from selling the merchantable material.

Market Situation for Merchantable Component of the Residue

Wood product prices vacillate according to market conditions. For example, the current market price for pine in this area in February 2008 is $5 to $10/ton. However, the prices are going down due to slowdowns in the housing market and because there is a surplus of pine. The surplus of pine on the market is caused by the mountain pine beetle epidemic in the Colorado and Wyoming lodgepole pine. Growing quantities of pine are being "dumped" on the market through service contracts and stewardship contracts where the logger is being paid to remove the dead or dying trees.

Aside from market conditions, most of the trees within the Gross Reservoir removal area are not highly desirable by the wood industry because of their relative short height and number of limbs (knots). Also, conventional logging truck access to most of the wood, even when decked, will be restrictive and expensive. However, there is a potential for conversion to a variety of small wood products. With the use of service contract(s) (subsidizing the logging or hauling cost depending on market conditions), disposal cost can be reduced if most of the logs (over 6 inches in diameter) were to be removed and utilized by the local wood product industry. Around the reservoir, Stands 4, 8, 9, 10, 16, 19, 20, 21, 22, and 23 are all on slopes that can be logged with conventional methods. With the use of service contracts, local loggers could clear cut and remove the timber on over 100 acres (the above listed Stands) and machine pile the slash for disposal later. One hundred acres is one fourth the total acreage and accounts for possibly 7,500 to 12,500 tons or 15 to 25 % of the total tonnage. **At current market prices of $5 to $10/ton, this could potentially generate $37,500 to $125,000 in income that could be applied to offset the project costs.** As previously discussed, the tonnage to be disposed could be reduced by 25,000 tons or 50% of the total if all the heavier pieces of wood throughout the removal area could be hauled away and utilized for firewood or some other wood product. Marketing the merchantable wood or paying a small fee to have it hauled to a local mill rather than burning it could generate substantial savings in disposal cost. Possibly the future tree removal contractor could consider salvaging the heavier (logs) when developing a proposal to remove all trees within 7410'.

Currently the most likely outlet for the small sized material coming from this project may be firewood sales or giveaway. There are approximately 3,800 cords of ponderosa pine and Douglas fir firewood within the area to be cleared. There will be a cost associated with disposing of the firewood. The least-cost approach will be to allow someone to salvage all the firewood for free. This approach will involve administering the salvage operation. The highest cost method to remove firewood from the slash is to buck and split all the wood and allow people to haul it off. The method selected depends on how much control Denver Water feels they need over the pace and quality of the firewood operation.

SUMMARY OF METHODS AND COSTS

Table 6 displays the costs for tree removal, options for residue removal and savings resulting from product utilization. The costs do not include improvement of the Winiger Ridge road (Forest Road #359). **In general, total costs range from $2.27 million for tree removal combined with product utilization and use of Air Curtain Destructors to as much as $6.51 million for tree removal and whole tree haul to a landfill without product utilization.**

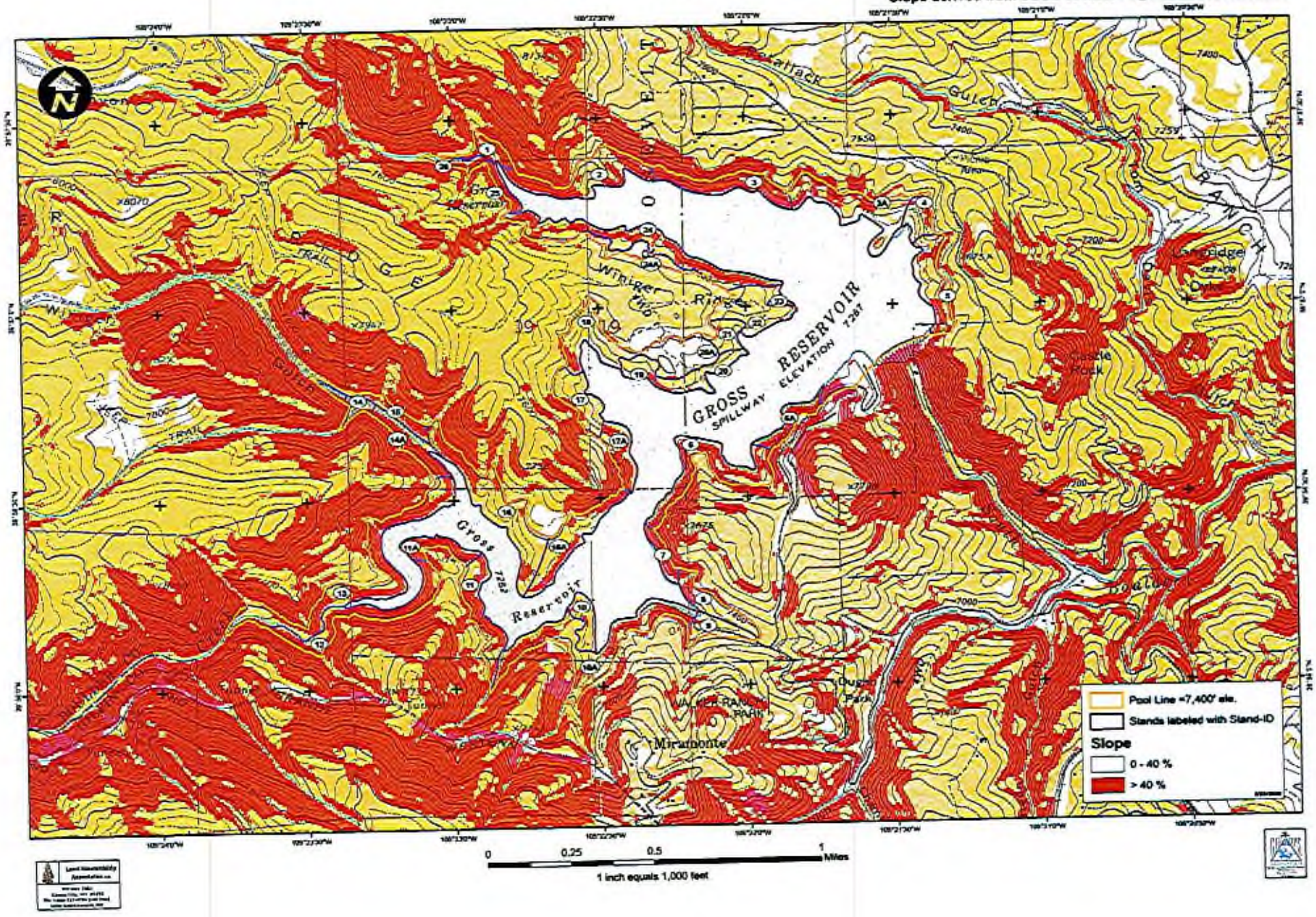
Table 6: Summary of Costs for Tree and Residue Removal and Utilization Reduction ($)

Tree Removal Costs*	Residue Removal Costs **			Tree & Residue Removal Costs	Utilization Savings Reduction***	Total Costs****
	Air Curtain Destructors	Grind & Landfill	Whole Tree To Landfill			
$ 1,782,100	$ 1,177,517			$ 2,959,617	$ 688,758	$ 2,270,859
$ 1,782,100		$ 3,791,050		$ 5,573,150	$ 1,995,525	$ 3,577,625
$ 1,782,100			$ 4,728,800	$ 6,510,900	$ 2,491,400	$ 4,019,500

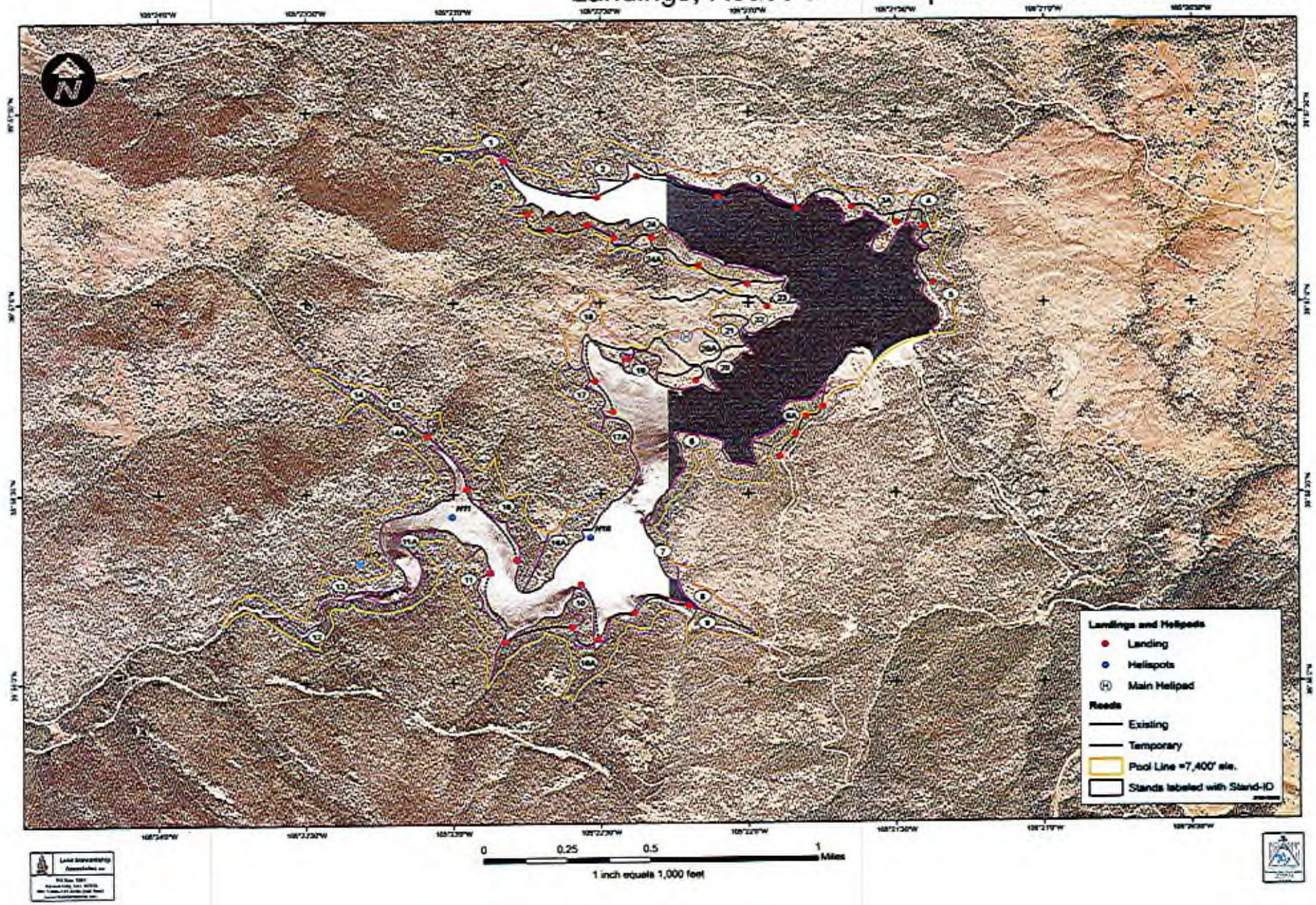
* From Table 2.
** From Table 4—includes load and haul costs to landfill.
*** In addition to savings from Table 5, utilization reduction includes $100,000 from product sales assuming 10,000 tons at a market value of $10/ton.
**** Does not include costs associated with improvement of the Winiger Ridge road (#359)

Map A - Slope, Pool Line & Stands - Gross Reservoir Area

Slope derived from USGS 10 meter digital elevation models



Map B - 2005 NAIP aerial with Stands, Landings, Roads and Helispots - Gross Reservoir Area



APPENDIX II: REFERENCES

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APPENDIX III: LIST OF POTENTIAL OPERATORS/MILLS

Mill Creek Enterprises

125 W. Swallow Road Fort Collins, CO 80525 970-207-9428	e-mail	andreMCE@Juno.com
	website	

PRODUCTS: High-quality mulch derived from Colorado slash.

Morgan Timber Products

5722 W. County Rd. 54E Bellvue, CO 80512-7101 970-484-4065	e-mail	mtpksm@hotmail.com
	website	

PRODUCTS: Western Rail fencing (2,3 &4 rail) both massive and standard size. Field posts, rails, barnpoles, houselogs, handrail, security fence, privacy fence, timbres, specialty wood products, firewood, peelings, chips, mulch.

Rocks & Pines Forest Products

e-mail	rocksandpines@juno.com
website	

PRODUCTS: Treated and untreated fence posts, corral poles, barn poles, log railings and buck fence. Pole gates and h... rail/tenon-jointed 2, 3 and 4 fencing. Buried character logs, f... mulch and livestock bedding from shavings. Firewood in cords or bundled.

July, 2008

Renewable Fiber

8395 U.S. Hwy. 85 P.O. Box 205 Fort Lupton, CO 80621 303-857-0763	e-mail	cspaulding@renewablefiber.com
	website	www.renewablefiber.com

PRODUCTS: Compost and soil products; mulch and bark products; rock products; edging and supplies, animal bedding; landscape timbers; truckload quantities of firewood; and bioenergy fuel.

United Wood Products Inc.

7860 Diagonal Hwy. Longmont, CO 80503-8760 303-652-2872	e-mail	uwp@unitedwoodproductsinc.com
	website	unitedwoodproductsinc.com

PRODUCTS: Rough-sawn pine, aspen, slabwood, custom sawing and machining, specialty fencing, tongue & groove aspen & pine. Log-rail systems (unpeeled, machine-peeled and hand-peeled) made to fit. Logs with bark, machine peeled or hand-peeled, custom ripping, grooving and cutting of logs. Unpeeled, machine-peeled or hand-peeled posts, poles or rails. Western rail or tenon-joint fence, buck fence, log gates and hardware, firewood, mulch, animal bedding and wood chips.

Armstrong Helicopters, LLC

1251 Haystack Dr. Castle Rock, CO 80104 877-777-9188	e-mail website

PRODUCTS: Flies UH1-F/H – a military version of Bell 210

Precision Helicopters

HCR 85, Box 139X Bonners Ferry, ID 83805 208-267-2169	e-mail website

PRODUCTS: Flies UH1-H AND Kaman HH43 B/F

Swanson Group Aviation

2794 Foothill Blvd Grants Pass, OR 97526 541-494-7600	e-mail website

PRODUCTS: Flies Kaman K-Max – payload to 6,000 lbs but costs similar to Bell 210

Intermountain Resources, LLC

11925 6530 Road Montrose, CO 81401 970-249-0812	e-mail website

PRODUCTS: Uses all species but aspen. Has conventional, feller/buncher and cable

Rue Logging, Inc.

PO Box 155 South Fork, CO 81154 719-873-5862	e-mail website

PRODUCTS: Conventional and feller/buncher logging, also has Hydroax

APPENDIX IV: RESIDUE VOLUME CALCULATIONS

Stand 5 (14 acres) (Match 47A)

SPECIES	DBH (INCHES)	HEIGHT (FEET)	TREES/ ACRE	WEIGHT/ TREE	#/ ACRE	TOTAL TONS
Doug fir	4	30	114	190	21660	
Doug fir	7	40	38	488	18544	
Doug fir	8	45	28	718	20104	
Ponderosa	8	35	28	718	20104	
Doug fir	10	48	18	958	17244	
Doug fir	12	50	31	1425	44175	
Total			257		141831	992.88

Stand 19 (4 acres) (Match 49A)

SPECIES	DBH (INCHES)	HEIGHT (FEET)	TREES/ ACRE	WEIGHT/ TREE	#/ ACRE	TOTAL TONS
Ponderosa	11	30	30	1176	35280	
Ponderosa	12	32	51	1514	77214	
Ponderosa	13	22	22	1790	39380	
Ponderosa	14	31	37	2123	78551	
Total			140		230425	460.84

Stands 4 & 7 (10 acres) (Match 54A)

SPECIES	DBH (INCHES)	HEIGHT (FEET)	TREES/ ACRE	WEIGHT/ TREE	#/ ACRE	TOTAL TONS
Ponderosa	8	22	28	718	20104	
Doug fir	8	20	28	718	20104	
Doug fir	9	31	45	839	37755	
Rocky Mtn Juniper	10	26	18	958	17244	
Doug fir	17	35	6	3320	19920	
Total			125		115127	575.60

Stand 24 (31 acres) (Match 58B)

SPECIES	DBH (INCHES)	HEIGHT (FEET)	TREES/ ACRE	WEIGHT/ TREE	#/ ACRE	TOTAL TONS
Ponderosa	4	17	458	190	87020	
Doug fir	4	15	229	190	43510	
Ponderosa	6	20	102	399	40698	
Ponderosa	7	20	299	546	163254	
Doug fir	8	21	57	718	40926	
Ponderosa	12	24	25	1514	37850	
Total			1170		413258	6,405.53

Stands 10, 11 & 17 (44 acres) (Match 60A)

SPECIES	DBH (INCHES)	HEIGHT (FEET)	TREES/ ACRE	WEIGHT/ TREE	#/ ACRE	TOTAL TONS
Ponderosa	8	35	57	718	40926	
Ponderosa	9	38	136	839	114104	
Ponderosa	10	40	37	958	35446	
Ponderosa	11	40	30	1176	35280	
Ponderosa	13	44	22	1790	39380	
Total			282		265136	5833.08

Stands 14 & 23 (14 acres) (Match 65A)

SPECIES	DBH (INCHES)	HEIGHT (FEET)	TREES/ ACRE	WEIGHT/ TREE	#/ ACRE	TOTAL TONS
Doug-fir	3	18	1,018	123	125214	
Doug-fir	4	18	229	190	43510	
Doug-fir	7	32	38	546	20748	
Ponderosa	8	17	28	718	20104	
Ponderosa	12	20	12	1514	18168	
Doug fir	13	25	11	1790	19690	
Doug fir	14	27	10	2123	21230	
Ponderosa	22	55	4	7286	29144	
Total			1,350		297808	2084.60

Stands 3,3A,8,15,20 & 22 (68 acres) (Match 65B)

SPECIES	DBH (INCHES)	HEIGHT (FEET)	TREES/ ACRE	WEIGHT/ TREE	#/ ACRE	TOTAL TONS
Ponderosa	5	16	147	286	42042	
Ponderosa	6	17	102	399	40698	
Ponderosa	10	15	37	958	35446	
Ponderosa	17	30	13	3320	43160	
Ponderosa	21	35	8	6392	51136	
Total			307		212482	7224.32

Stands 2,13,16,21 & 25 (99 acres) (Match 103A)

SPECIES	DBH (INCHES)	HEIGHT (FEET)	TREES/ ACRE	WEIGHT/ TREE	#/ ACRE	TOTAL TONS
Ponderosa	4	14	229	190	43510	
Ponderosa	5	16	147	286	42042	
Ponderosa	6	28	102	399	40698	
Ponderosa	7	25	75	546	40950	
Ponderosa	8	30	57	718	40926	
Ponderosa	9	35	45	839	37755	
Doug fir	10	40	37	958	35446	
Doug fir	12	44	25	1514	37850	
Total			717		319177	15799.41

Stand 9 (7 acres) (Match 107A)

SPECIES	DBH (INCHES)	HEIGHT (FEET)	TREES/ ACRE	WEIGHT/ TREE	#/ ACRE	TOTAL TONS
Ponderosa	7	30	75	546	40950	
Ponderosa	9	32	45	839	37755	
Ponderosa	10	34	37	958	37446	
Ponderosa	11	35	61	1176	71736	
Total			218		187887	657.58

Stand 6 (25 acres) (Match 108)

SPECIES	DBH (INCHES)	HEIGHT (FEET)	TREES/ ACRE	WEIGHT/ TREE	#/ ACRE	TOTAL TONS
Ponderosa	6	12	102	399	40698	
Doug fir	6	16	102	399	40698	
Doug fir	7	16	75	546	40950	
Ponderosa	9	23	45	839	37755	
Ponderosa	10	32	37	958	37446	
Doug fir	12	25	25	1514	37850	
Total			386		235397	2942.50

Stands 1, 10A, 12 & 26 (54 acres) (Match 109)

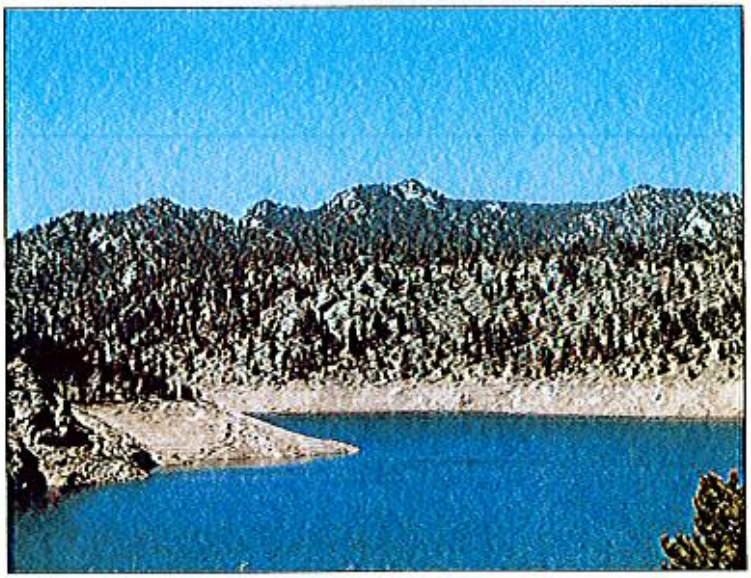
SPECIES	DBH (INCHES)	HEIGHT (FEET)	TREES/ ACRE	WEIGHT/ TREE	#/ ACRE	TOTAL TONS
Ponderosa	6	12	102	399	40698	
Ponderosa	8	19	57	718	40926	
Doug fir	9	22	45	839	39105	
Doug fir	11	24	30	1176	35280	
Ponderosa	16	28	14	2912	40768	
Total			248		196777	5313.06

SUPPLEMENT

TO

GROSS RESERVOIR

TREE REMOVAL PLAN FOR POOL ENLARGEMENT



October, 2008

Prepared by Land Stewardship Associates, LLC

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INTRODUCTION

The Colorado State Forest Service and Denver Water Department asked Land Stewardship Associates (LSA), LLC, to develop an alternative that involved greater use of helicopters for tree removal and elimination of temporary road construction below the current high water level of 7,287'. In addition, LSA was asked to evaluate a "green option" for residue recycling and identify haul/transportation routes for ingress and egress to the various stands. This report addresses the above concerns and should be considered a "supplement" to the original report titled "Gross Reservoir Tree Removal Plan for Pool Enlargement", February and July, 2008. The original report will be referred to as the "Plan" in this Supplement. This Supplement needs to be used in conjunction with the Plan, because some of the discussions reference material displayed in the Plan. While LSA prepared the report, a "thank you" goes to Chuck Dennis, Colorado State Forest Service, who did some of the field work, i.e. evaluated needs for access and reconstruction along FR 359 and field observations of the John Deere Slash Bundler, 1490D demonstration at Silverthorne.

ALTERNATIVE TREE REMOVAL METHOD

Six stands involving 85 acres were converted from cable (24 & 6A) and hand fall/grapple skidder (2, 3, 7 & 11) logging systems to a helicopter system (see Plan Maps A and B for location of Stands). All temporary roads below the high water line of 7,287' were removed, and new temporary roads were added as needed above the 7,287" level.

Table S1: Alternative Tree Removal Method for Stands contains the results of the **'LOGCOST 8.0'** analysis. Costs increased approximately $ 306,500 by converting to helicopter systems. Temporary roads above the high water line of 7,287' are incorporated in the cost estimates. The costs do not include reconstruction costs for the Winiger Ridge roads.

Map S1: Temporary Roads, Landings & Helispots for Alternative Tree Removal provides a display of the new landings, temporary roads and helispots. In addition, it identifies primitive roads on Winiger Ridge that will need some rebuilding. Discussions with USDA Forest Service indicate the Arapaho/Roosevelt National Forest is willing to work with, and permit, the Denver Water Department to do the reconstruction.

The logging systems analysis assumes that all whole tree logs would be lifted and placed at a landing near the main helipad. The helipad would be located at a favorable site in or adjacent to Stand 20A. The blue dots labeled as helispots on *Map* S1 are also called "pivot points" and are used to determine the most efficient routes for helicopters. In locating these helispots or pivot points, consideration was given to identifying areas with relatively flat ground that could be used as temporary or intermediate helicopter landings if necessary.

"GREEN" OPTION FOR RESIDUE RECYCLING

New technology has provided the opportunity to recycle slash more efficiently by use of a "slash bundler". Using a boom to place the slash, the bundler wraps/bundles the slash with nylon or bio-degradable sisal string and cuts the "slash log" to a predetermined length. The bundles are easier to handle and haul to recycling facilities. The bundling can reduce the volume by as much as 50 to 80%. In addition, by letting the bundles dry at landings, the ultimate hauling weight can be reduced substantially.

As Plan, Table 4 indicates, the logging will produce about 50,000 tons of residue, which involves roughly ½ being tree-top slash and the other ½ being boles with firewood and lumber in it. The slash will be placed in landings next to the helipad for helicopter logging or on the field landings for hand fall/grapple

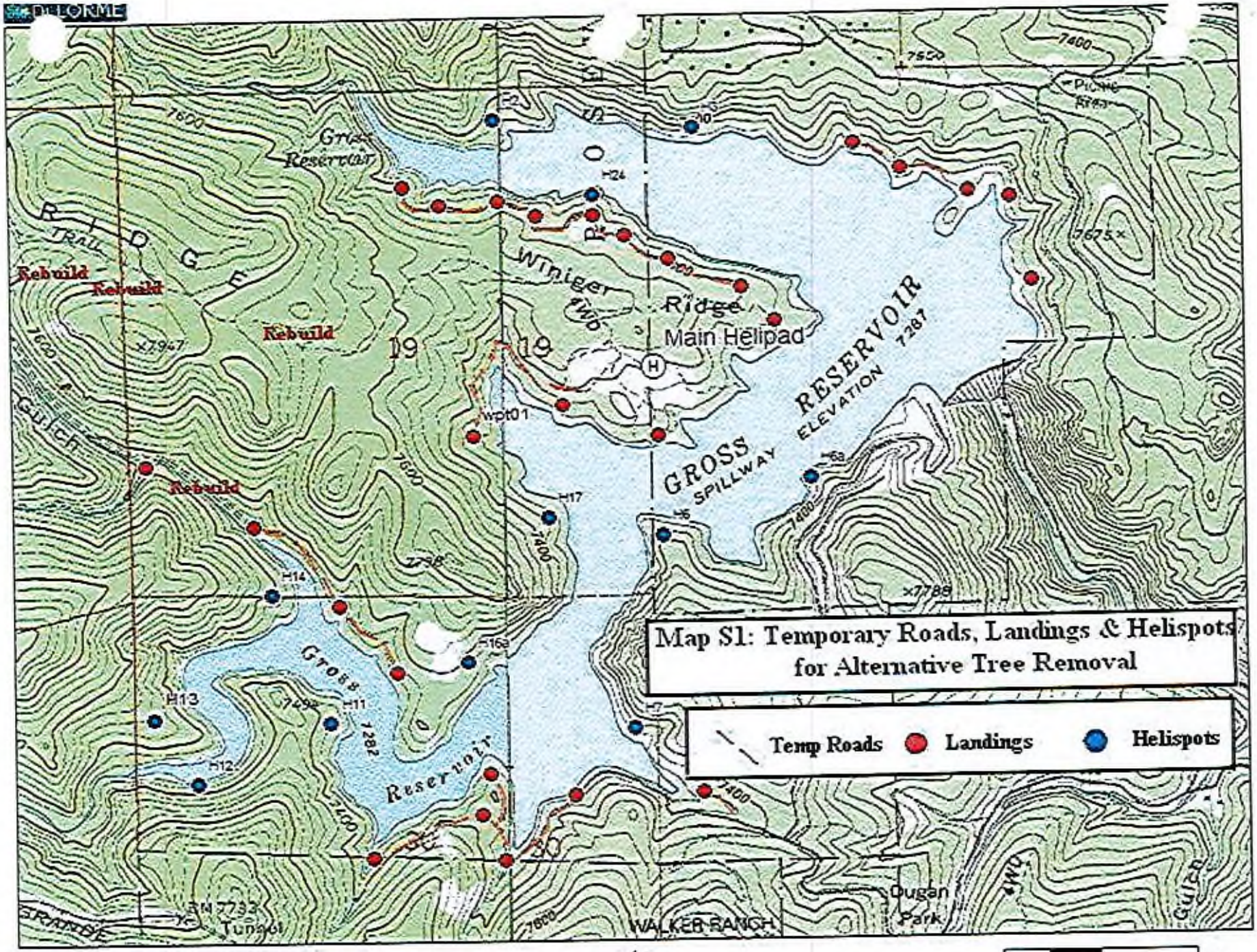
Table S1: Alternative Tree Removal Methods for Stands

Stand ID	Slope (%)	Acres*	Dominant Vegetation**	Stems (#/AC)	Merch Vol (CCF)***	Tree Removal Method	Costs ($)	Match**** (Tract #)	Comments
1	Mix	6	J, PP, DF, Shrub	248	0	Hydro-ax	3,750	109	Not loggable
2	Mix	20	DF, PP	717	246	**Helicopter #**	182,000	103A	
26	>40	5	J, PP, DF, Shrub	248	0	Hydro-ax	3,000	109	Not loggable
25	>40	3	J, PP, DF, Shrub	717	0	none	0	103A	Cliff, hand fell a few trees
3	>40	13	PP,DF,J	307	66	**Helicopter #**	49,000	65B	
3A	Mix	20	PP,DF,J	307	105	Hand fall, grapple skidder	28,800	65B	
4	<40	6	DF, PP, J	125	31	Hand fall, grapple skidder	6,000	54A	
24	>40	27	DF, PP	1,170	76	**Helicopter #**	153,700	58B	
24A	<40	8	DF, PP	1,170	18	Hand fall, grapple skidder	15,550	58B	
5	Mix	14	DF, PP	257	170	Hand fall, grapple skidder	37,350	47A	
22	<40	15	PP	307	75	Feller/buncher	19,750	65B	
18	<40	15	Shrub, Grass				0	Savanna	No treatment
23	<40	1	PP, DF	1,350	6	Hand fall, grapple skidder	4,300	65A	
21	<40	6	PP, DF	717	70	Feller/buncher	16,800	103A	
20	<40	8	PP	307	41	Feller/buncher	10,900	65B	
19	<40	4	PP	140	53	Feller/buncher	3,750	49A	
16	<40	28	PP, DF	717	352	Hand fall, grapple skidder	102,950	103A	
16A	Mix	15	PP, DF	717	194	Helicopter	114,600	103A	
14	<40	5	PP, DF	1,350	25	Hand fall, grapple skidder	16,100	65A	
14A	>40	10	PP, DF	1,350	45	Helicopter	77,400	65A	
15	>40	6	PP	307	30	Hand fall, grapple skidder	7,600	65B	
6	>40	20	PP, DF	386	126	Helicopter	85,800	108	
6A	>40	6	PP, DF	386	55	**Helicopter #**	36,250	108	
13	Mix	35	PP, DF, J, Shrub	717	427	Helicopter	442,600	103A	
7	>40	4	DF, PP, J	125	21	**Helicopter #**	8,000	54A	
11	Mix	15	PP, DF	282	360	**Helicopter #**	239,300	60A	
11A	>40	7	PP, DF	282	180	Helicopter	74,350	60A	
12	>40	17	DF, PP	248	91	Helicopter	102,200	109	
8	<40	10	PP	307	47	Feller/buncher	12,550	65B	
10	<40	6	PP	282	159	Hand fall, grapple skidder	32,500	60A	
10A	Mix	31	DF, PP	248	161	Hand fall, grapple skidder	43,000	109	

Table S1: Recommended Tree Removal Methods for Stands (continued)

Stand ID	Slope (%)	Acres*	Dominant Vegetation**	Stems (#/AC)	Merch Vol (CCF)***	Tree Removal Method	Costs ($)	Match**** (Tract #)	Comments
9	<40	8	PP	218	84	Feller/buncher	8,550	107A	
17	<40	12	PP	282	279	Hand fall, grapple skidder	68,400	60A	
17A	>40	9	PP	282	231	Helicopter	121,500	60A	
20A	<40	15	Grass, Rock, Shrub				0	Savanna	Helipad, ACDs, Log decks
Totals		**430**			**3,824**		**$2,088,650**		

* Includes removing trees to 7,410', or 10 feet above the new pool level of 7,400'.
** PP=ponderosa pine, DF=Douglas fir, J=Rocky Mountain juniper.
*** Merchantable Volume in Hundred Cubic Feet, assuming trees with 8" dbh and 20' height
**** Tracts from "Gross Reservoir Forest Management Plan Update", May 22, 2005.
# New helicopter logging stands to remove temporary roads from below the 7,287" high water level.



Map S1: Temporary Roads, Landings & Helispots for Alternative Tree Removal

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www.delorme.com

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skidder stands (see *Map S1: Gross Reservoir Temp Roads, Landings and Helispots* for location of the landings).

John Deere 1490D Slash Bundler

Using the manufacturer's studies for the John Deere 1490D Slash Bundler (see *Appendix III*) and conservative or low productivity data (15 bundles/hour), which indicates bundling costs of about $22.16/ton, the cost of bundling 25,000 tons of tree tops slash would be about $554,000 Assuming that the bundler will reduce volume of slash by 30 percent, hauling costs would involve about 1,537 round trips costing $307,434. With tipping fees assumed to be $7/yard (from A-1 Organics at Platteville) or $1,065,260, **total costs for bundling, hauling and tipping the bundled tops would be about $1,619,260.**

Further assuming that the other 25,000 tons of the slash (boles) is utilized for firewood and sawtimber it would take about 926 round trips to the mills, costing $185,200. With a conservative market value of $10/ton, as assumed in the Plan, and that the boles would yield about 10,000 tons of merchantable material, $100,000 could be applied to the hauling costs, reducing hauling to $85,200. Adding this to the above bundling/hauling/tipping costs for tree tops, would indicate that **total costs for bundling, hauling and tipping the tops, and hauling and selling part of the boles would be about $1,704,460.**

Adding the original Plan's logging cost of $1,782,000, total cost is $3,486,460, which is about the same as the Grind and Landfill total costs (see Plan Table 6, last column). Using the alternative logging costs of $2,088,650 from *Table S1: Alternative Tree Removal Methods for Stands*, total costs for logging more with helicopters and removing the residue tree tops by bundling and utilizing some of the tree boles for lumber, **total costs are estimated at $3,793,110.**

It should be noted that the bundler is new technology and at this time there are no operators in Colorado that have a bundler. However, several contractors within the State have indicated an interest in purchasing a bundler. For future reference, *Appendix II* of this Supplement is a list of contractors for each of the Front Range CSFS Districts.

Also, markets for bundler products have not been developed. For example, landscape material producers have indicated that they would like the material but would charge a tipping fee at their manufacturing site. However, over time it is hoped that markets would be developed, such as landscape chips and ground cover, pellets for fuel and maybe even soil/ditch erosion barriers.

In general, it should be noted that the forest products markets are highly volatile, especially in this time of economic downturn. For example, at least one mill indicated they might be willing to pay up to $30/ton for pine depending on the condition of the timber. These opportunities should be evaluated prior to implementing the project.

TRANSPORTATION

Temporary Roads

Temporary roads are needed to log Stands 3A, 4, 5, 8, 10, 10A, 16, 17, 18, 19, 24 and 24A and are shown on *MapS1*. Costs for the temporary roads are estimated at $1.00/foot and are included in the logging system costs.

Long haul log forwarders may be a benefit on this project. Cost of a long haul log forwarder is about $360,000.

Access/Haul Routes

Gross Reservoir should be accessed primarily from State Highway (SH) 72 which connects with SH 93 between Golden and Boulder. An alternative route on Flagstaff Road can be used, however the distance to SH 93 through the mountains and foothills is longer.

The **NE** and **SE Haul Routes** use Gross Dam Road. Gross Dam Road intersects SH 72 at Crescent Village and goes north to the reservoir. Denver Water maintenance buildings in Nineteen Gulch are along Gross Dam Road and are about 3 miles north of SH 72. The **Winiger Ridge Haul Route** uses County Road (CR) 97, going north, which is about ¼ mile north of Pinecliffe along SH 72. See *Table* S2:*Stands and Volumes for Haul Routes* for a summary.

NE (Northeast) Haul Route – Existing and new temporary roads for stands 3A, 4 and 5 will access Gross Dam Road close to the intersection of Gross Dam Road and Flagstaff Road. Trucks and equipment would go south about 4.5 miles on Gross Dam Road to SH 72.

SE (Southeast) Haul Route – New temporary roads for Stands 8, 9, and 10A will be accessed by using the boat ramp road, which runs south and east of the reservoir for about 1.5 miles and connects with Gross Dam Road at the maintenance building sites in Nineteen Gulch. Trucks and equipment would go south for about 3 miles on Gross Dam Road to SH 72.

Winiger Ridge (West) Haul Route – The remaining stands, main helipad, possible location for ACD's and general staging areas, landings and log decks, etc. will be accessed on Forest Road (FR) 359 (sometimes called Winiger Ridge Road). Going west and south, the route goes about 8 miles from FR 359 to CR 68 and CR 123 to reach CR 97, which connects with SH 72 near Pinecliffe. CR 97E has a private land gate on it so it is not recommended for access to the old Winiger Gulch road or stands. A new temporary road will likely need to be constructed from the old Winiger Gulch road to the Winiger Ridge road (FR 359). This temporary road is identified to "rebuild" on *Map S1*.

Sections of FR 359 will need rebuilding/reconstruction on some turns and grades. These areas are identified as "rebuild" on *Map S1*. The costs of this reconstruction is not included in this Supplement or the original Plan.

Table S2: Stands and Volumes for Haul Routes

Route	Stands	Haul Volume (tons)
NE (northeast)	3A,4,&5	3,462
SE (southeast)	8,9,10,&10A	5,565
Winiger Ridge (west)	2,3,6,6A,11,11A,12,13,14,14A,15,16, 16A, 17,17A,19,20,21,22,23,24&24A	44,572

SUMMARY OF METHODS AND COSTS

Table 3:Summary of Costs for the Alternative Tree Removal Method, Residue Removal Options including use of Bundler, and Utilization Reduction ($) displays the costs for tree removal using more helicopter logging, options for residue removal including use of a bundler for tree tops, and savings resulting from product utilization. The costs do not include improvement of the Winiger Ridge road (Forest Road 359). **In general, total costs range from $2.58 million for tree removal combined with product utilization and use of Air Curtain Destructors to as much as $6.82 million for tree removal and whole tree haul to a landfill without product utilization. Total costs when using the "Green Option" is similar in cost to chipping and hauling to the landfill.** Table S3 can be used in conjunction with Table 6 in the original Plan to obtain a summary of information on use of cable and other more conventional logging systems.

Table S3: Summary of Costs for the Alternative Tree Removal Method, Residue Removal Options including use of Bundler, and Utilization Reduction ($)

Alternative Tree Removal Costs*	Residue Removal Costs ($) **				Tree & Residue Removal Costs ($)	Utilization Savings*** Reduction ($)	Total Costs**** ($)
	Air Curtain Destructor	Grind & Landfill	Whole Tree To Landfill	Bundle Tops Utilize Boles			
$2,088,650	1,177,517				$ 3,266167	$ 688,758	$ 2,577409
$2,088,650		3,791,050			$ 5,879,700	$ 1,995,525	$ 3,884,175
$2,088,650			4,728,800		$ 6,817,450	$ 2,491,400	$ 4,326,050
$2,088,650				1,704,460 #	$3,793,110 #	0	$3,793,110

* From Table 1S.

** From Plan Table 4 for ACD's, Grind & Landfill and Whole Tree to Landfill—includes load and haul costs to landfill.

*** In addition to savings from Table 5, includes $100,000 from product sales assuming 10,000 tons at a market value of $10/ton.

**** Does not include costs associated with improvement of the Winiger Ridge road (FR 359)

\# Includes Utilization Savings.

APPENDIX I – CONTRACTOR LISTS

Woodland Park Contractor List

Work Phone	Fax	Cell	Email	Web Address	Services
(719) 837-2870		(719) 207-2647			Large scale transplant sales
(719) 531-0929			jmcgannon@msn.com		Forest Management plans, Landscape damage appraisals, General natural resource management
(719) 684-2333					Revegetation/forest management, sick tree diagnosis, windbreak design, home wildfire protection, landscape design, erosion control
(719) 630-3209			beckywegner@mountainnightree.com		Sick tree inspections, tree damage appraisals, management plans, timber marking
		(719) 661-4603	chapeljason@yahoo.com		Tree removal
(303) 535-5312					Forest Thinning, pruning, tree transplanting, fire mitigation
(719) 836-7166					Bug tree removal, defensible space, fire mitigation/general thinning
(719) 761-7663	(206) 339-5537	(719) 761-7663	wwoodrau@aim.com		Tree removal/purning (included MPB & hazard trees). Chipping, defensible space, firewood sales-splitting, forest thinning residential and commercial.
(719) 481-4662	(719) 481-4662				Slash & hazard tree removal, dwarf mistletoe control, wildland fire safety consultations, free estimates
(719) 684-2093	(719) 587-5587	(719) 237-3911			bark beetle removal, wildfire mitigation, has an ASB skidloader with a mulching bull head attachment and grapple attachment
(303) 665-3473			rod@anchorpointgroup.com	www.AnchorPointGroup.com	Forest Ag tax plans, Community Wildfire Prevention Plans, Forest Mgmt. plans, Prescribed fire planning & implementation, fire training
(719) 395-2696		(719) 337-2756		www.aquaticalt.com	Forest thinning, erosion control, fire mitigation, brush removal
(719) 684-2336					17 yrs. Exp. in Teller, Park, & El Paso counties.
719) 686-0249					Fire mitigation, grinding, earthwork (i.e. erosion control)
9) 596-1645					Black Forest, Monument, Calhan
(719) 495-8328		(303) 660-9662			Tree spraying
(719) 494-4494					Transplanting
(719) 748-0033	(719) 748-0007		jonathan@uppersouthplatte.net		Upper South Platte Watershed, fuel mitigation, fire rehab
(970) 214-7677			coloradoforestmanagement@comcast.net	doforestmanagement/	Forest stewardship management plans, Forest ag management plans
(719) 237-7016			bostoncolorado@peakinet.net		timberframe sturctures, log railing, hardwoods, custom beams from thinning operations
(719) 481-4916					Gardening, landscaping, forestry. Dwarf mistletoe/mountain pine beetle detection, marking for thinning, planting, management plans
(719) 638-1210	(719) 636-1233	(303) 755-7452	brett.lemain@davey.com	www.davey.com	Residential & Commercial: Insect & Disease control, lawn aeration, fertilization & weed control, tree & shrub pruning, removal, cabling
(719) 687-0781			DivideTimber@aol.com		
(303) 205-1915			mbw9245@comcast.net		Certified Forester. Forest inventory, wildfire mitigation, land use planning
(719) 494-1820		(719) 659-3383	csprings@fireready.com	www.fireready.com	Wildfire resistant landscaping, defensible space, wildfire protection, tree & brush removal, large capacity chipping service
(719) 539-4944				salida@fireready.com	Wildfire mitigation, fuel reduction, chipping service, tree thinning, forest clean-up
(719) 686-0402		(970) 209-3383	graybros2005@msn.com		MPB treatment, hazardous tree removal, defensible space, lot clearing, chipping, thinning
(719) 783-4250		(719) 429-4404	len@greenleafforestry.com	m	Full forest management planning, operations, and lumber/wood processing/manufacturing.
(719) 748-5062		(719) 510-1669			Tree & brush removal/trimming, chipping
(719) 593-9610			anodk@aol.com		Fire hazard mitigation, thinning, pruning
(719) 687-2177			tkiweaver@aol.com		Thinning, dwarf mistletoe control/removal, mountain pine beetle control/removal, chipping
(719) 837-2422					Logging, log homes, hand railings, siding, rough saw timber, firewood
(877)-674-8733	(303)-674-8733		mike@lamtree.com		Fuel reduction, timber stand improvement
(719) 382-0522		(719) 290-3610	merantwo@earthlink.net		Fire mitigation, forest health, onsite milling & preparation of firewood-using logging horses.
(303) 646-3647		(303) 646-3369			Thinning, defensible space, chipping
(719) 630-3209			beawegner@adelphia.com		Trimming/removals, tree surgery, insect & disease diagnosis /control, hazard tree evaluation, tree appraisal/evaluation, soil & DED injections
(719) 651-3667			renegadeexe@aol.com		Fuel mitigation, MPB removal, planting, thinning
(719) 579-9103		(719) 491-4626	scott@adelphia.net	www.rockytop.us	Land clearing, tub grinding
(719) 673-5662		(719) 650-0151	ruelogging@yahoo.com		Tree thinning, hydro mowing
	(719) 207-0468				Wildfire mitigation, thinning, insect & disease detection, Timber Mgmt. plans, raking with skidder
719) 687-6611			MPineBeetle@aol.com		Licensed by CO Dept. of Ag., tree spraying/insect control, spring/fall tree fertilization, micro-injection
		(719) 492-8129			tree to 2500 acres.
(719) 481-2331			gregwiggins@msn.com		Thinning, pruning, marking, insect & disease, forest management, reforestation, fire mitigation, dspace, native grass seeding
(970) 921-5460	(970) 921-5461		info@westrangereclamation.com		Precommercial thinning, mastication projects, fuels reduction
(970) 221-1336			billgherardi@comcast.net		Forest management & plans, I/D survey and treatment, timber sale marking and administration, wildfire hazard reduction

Woodland Park Contractor List

nsultant/Contracto	Consultant	Spraying	Contractor	Business Name	First Name	Last Name	Address	City	State	Zip
65	FALSE	FALSE	TRUE		Jim	Subler	P.O. Box 6865	Breckenridge	CO	80424
61	TRUE	FALSE	FALSE		Jim	McGannon	PO Box 51223	Colorado Springs	CO	80949-1223
64	TRUE	FALSE	FALSE		Steve	Spaulding	PO Box 96	Green Mountain Falls	CO	80819
67	TRUE	FALSE	TRUE	Mountain High Tree Service, Inc.	Becky	Wegner	906 Canopus Drive	Colorado Springs	CO	80906
60	FALSE	FALSE	TRUE		Jason	Chappell	140 Trail Creek Rd.	Lake George	CO	80827
23	FALSE	FALSE	TRUE		Jim	Green	PO Box 193	Buffalo Creek	CO	80425
50	FALSE	FALSE	TRUE		Dean	Wierth	PO Box 89	Hartsel	CO	80449
102	FALSE	FALSE	TRUE	AA Forestry LLC	Raul	Acosta	4275 Gracewood Dr.	Colorado Springs	CO	80920
1	FALSE	FALSE	TRUE	A-C	Gasper	Bisa	PO Box 866	Monument	CO	80132
98	FALSE	FALSE	TRUE	American Wildfire Mitigation Service	Andy	Pittman	PO Box 323	Green Mountain Falls	CO	80819
55	TRUE	FALSE	FALSE	Anchor Point Group	Rod	Morago	3775 Iris Ave., Suite 2A	Boulder	CO	80301
4	FALSE	FALSE	TRUE	Forest Technologies	Hal	Hagan	PO Box 160	Nathrop	CO	81236
91	TRUE	FALSE	FALSE	B&B Forest Consultants	Dennis	Will	8910 Chipita Park Rd.	Chipita Park	CO	80809
6	FALSE	FALSE	TRUE	Baker Site Development	Terry	Baker	PO Box 4047	Woodland Park	CO	80866
69	FALSE	TRUE	FALSE	Bob Rundo Tree Surgeon	Albert	Godec	2626 Gunnison Street	Colorado Springs	CO	80909
9	FALSE	FALSE	TRUE	C Lazy T Spraying Service, LLC	Greg	Cole	10660 Eastonville Road	Elbert	CO	80106
10	FALSE	FALSE	TRUE	C Lazy T Tree Movers	Suzy	Cole	6074 CR 82	Elbert	CO	80106
101	FALSE	FALSE	TRUE	Coalition for the Upper South Platte	Jon	Bruno	P.O. Box 726	Lake George	CO	80829
57	TRUE	FALSE	FALSE	Colorado Forest Management	Stefan	Rainold, MS	3290 Newland St.	Wheat Ridge	CO	80033
94	FALSE	FALSE	TRUE	Colorado Log & Wood Products, LLC	David	Boston	PO Box 7176	Woodland Park	CO	80863
56	TRUE	FALSE	FALSE	Coons Country Gardens	Suzanne	Coons	727 Meadow Lane	Palmer Lake	CO	80133
71	FALSE	TRUE	TRUE	Davey Tree & Lawn Care	Brett	LeMaire	PO Box 50704	Colorado Springs	CO	80949
15	FALSE	FALSE	TRUE	Divide Timber	Mike	Isele	1644 Cedar Mountain Road	Divide	CO	80814
104	TRUE	FALSE	FALSE	Double W Services, Inc.	Bill	Williams	969 Carr St.	Lakewood	CO	80214
18	TRUE	FALSE	TRUE	Fire Ready	Andrew	Notbohm	845 E. Kiowa St.	Colorado Springs	CO	80903
19	FALSE	FALSE	TRUE	Fire Ready	Angie	Jensen	PO Box 315	Salida	CO	81201
79	FALSE	FALSE	TRUE	Gray Brothers	Shane	Gray	1430 Evergreen Heights	Woodland Park	CO	80863
80	TRUE	FALSE	FALSE	Greenleaf Forestry and Wood Products	Len	Lankford	1500 Rosita Road	Westcliffe	CO	81252
24	FALSE	FALSE	TRUE	Hanson Tree Service	Ira	Hanson	PO Box 243	Florissant	CO	80816
25	FALSE	FALSE	TRUE	Horti Care Tree & Shrub	Greg	Eno	7160 Alpenwood Way	Colorado Springs	CO	80918
26	FALSE	FALSE	TRUE	K & K Tree Service/Chipping	Korey	Weaver	515 East South Avenue	Woodland Park	CO	80863
28	FALSE	FALSE	TRUE	L & M Havens Logging, LLC			PO Box 153	Hartsel	CO	80449
	FALSE	FALSE	TRUE	LAM Tree Service, Inc.	Mike	Goldblatt	P.O. Box 2466	Evergreen	CO	80437
95	FALSE	FALSE	TRUE	Marantwo, LLC	Carl & Elizabeth	Evans	13825 Old Pueblo Rd.	Fountain	CO	80817
32	FALSE	FALSE	TRUE	Miller Tree Service	Jobe	Miller	PO Box 104	Elizabeth	CO	80107
62	TRUE	FALSE	TRUE	Mountain High Tree Service, Inc.	Al	Wegner	906 Canopus Drive	Colorado Springs	CO	80906
7	FALSE	FALSE	TRUE	Renegade Excavating	Ben	Burdick	P.O. Box 116	Yoder	CO	80864
84	FALSE	FALSE	TRUE	Rocky Top Resources, Inc.	Scott	Piggot	1755 E. Las Vegas	Colorado Springs	CO	80903
36	FALSE	FALSE	TRUE	Rue Logging, Inc.	Brian	Rue	PO Box 155	South Fork	CO	81154
42	FALSE	FALSE	TRUE	Timberland Management Services	Dan	Estep	13580 County Rd. 140	Salida	CO	81201
43	FALSE	TRUE	TRUE	Timberline Spraying & Services	Don	Doty	175 Elk Park Rd.	Woodland Park	CO	80863-8974
45	TRUE	FALSE	TRUE	Tree Masters	John	Pwensky	PO Box 3249	Monument	CO	80132
49	FALSE	FALSE	TRUE	Tri-Lakes Timber Management	Greg	Wiggins	17615 Saddlewood Road	Monument	CO	80132
76	FALSE	FALSE	TRUE	West Range Reclamation, LLC	Stephanie	Neff	36702 Fruitland Mesa Road	Crawford	CO	81415
68	TRUE	FALSE	FALSE	Woodland Management Consultants	Bill	Gherardi	PO Box 19	Fort Collins	CO	80522

Colorado State FOREST SERVICE

Boulder District 303-823-5774

Updated 06-22-2007

The Colorado State Forest Service-Boulder District maintains this list as a service to its customers only. This list is comprised of known forest contractors that have indicated the capability and interest to offer the services listed below. The list is updated periodically for additions and changes. CSFS does not specifically recommend any of the contractors on this list. No endorsements and no representation for services are implied by the presence or absence of a possible contractor name. Please contact the contractors directly for pricing, bonding or insurance, professional qualifications, and previous customer referrals.

* For more information pertaining to marketing local wood products reference www.coloradoforestproducts.org

FORESTRY CONTRACTORS

CONTRACTOR NAME	ADDRESS	CONTACT INFORAMATION	Consulting Forester	General Tree Cutting	Logging/ Salvage	Chipping, Slash Removal	Defensible Space	Forest/fire Management Plans	Prescribed Fire	MPB Diagnosis & Removal	Insect, Disease, & Weed Spraying	Sawmills & Wood Processing	Fire Rehab	Wood Product Purchasing	Insured
ALTA Tree Services Walter Chapman	P.O. Box 35 Nederland, CO. 80466	303-258-0354 (phone)		X	X	X	X	X		X		X		X	X
Anchor Point Group Rod Moraga	3775 Iris Ave. Suite 2A Boulder, CO. 80301	303-665-3473 (phone) 720-221-8016 (fax) info@AnchorPointGroup.com	X				X	X	X				X		X
Andrews Lawn Care Rob & Ellen	P.O. Box 4789 Boulder, CO 80306	303-447-2050 (phone) robandeljames@comcast.com		X		X	X								X
Arbor-Care Tree Company, Inc. Chad Ferry	P.O. Box 160 Louisville, CO. 80027	303-664-9217 (phone)		X		X	X			X					X
				X	X	X	X			X			X		

CONTRACTOR NAME	ADDRESS	CONTACT INFORAMATION	Consulting Forester	General Tree Cutting	Logging/ Salvage	Chipping, Slash Removal	Defensible Space	Forest/Fire Management Plans	Prescribed Fire	MPB Diagnosis & Removal	Insect, Disease, & Weed Spraying	Sawmills & Wood Processing	Fire Rehab	Wood Produc Purchasing	Insured
Beaver Envy Scott Deyo	P.O. Box 396 Rollinsville, CO. 80474	303-258-3863 (phone) deyosa@highstream.net													
Big Rocks Excavating Josh Camp	P.O. Box 7086 Golden, CO 80403	303-642-7272 (phone) 303-642-7059 (fax)		X	X	X	X			X		X	X		X
Blue Mountain Environmental Consulting, LLC Matt Tobler	937 Mallard Drive Fort Collins, CO 80521	970-224-0851 (phone) 970-224-0851 (fax) matt@bluemountain1.net	X				X	X					X		X
Boulder Mountain Fire Protection District Steve Lynn	1905 Linden Drive Boulder, CO 80304	303-440-0235 (phone) 303-859-4661 (cell) 303-440-5247 (fax) mitigation@bouldermountainfire.org		X		X	X			X			X		X
Bustamante Wood Products Abe Bustamante	P.O. Box 264 Mead, CO. 80542	303-652-3394 (phone) 303-775-5552 (cell)		X	X	X		X		X		X		X	X
Colorado Forest Management Stefan Reinold	3290 Newland Street Wheat Ridge, CO 80033	970-214-7677 (phone) coloradoforestmanagement@comcast.net	X												
Davey Tree Brian O'Niel	P.O. Box 1396 Boulder, CO. 80306	303-449-2525 (phone) 303-413-1042 (fax)		X		X	X	X		X	X				X

CONTRACTOR NAME	ADDRESS	CONTACT INFORAMATION	Consulting Forester	General Tree Cutting	Logging/ Salvage	Chipping, Slash Removal	Defensible Space	Forest/Fire Management Plans	Prescribed Fire	MPB Diagnosis & Removal	Insect, Disease, & Weed Spraying	Sawmills & Wood Processing	Fire Rehab	Wood Product Purchasing	Insured
Daylight Again Farm David Lasky	3660 Sugarloaf Road Boulder, CO 80302-9296	303-588-3440 (phone) davidlasky@sugarloaf.net		X	X	X	X			X		X			
Diamond Tree Service Howard Burkhart	P.O. Box 3781 Estes Park, CO 80517	970-586-4735 (phone) 970-577-0279 (fax)		X	X	X	X	X	X	X					X
Double W Services, Inc Bill Williams	969 Carr Street Lakewood, CO 80214	303-205-1915 (phone) mbw9245@comcast.net	X					X							
Ecoscape Environmental Design, LLC Bill Melvin	P.O. Box 704 Boulder, CO 80306	303-447-2282 (phone) Bill@EcoscapeDesign.com	X	X	X	X	X	X		X		X	X	X	X
Firewise Landscaping Joe Turner	140 Judson Street Longmont, CO. 80501	1) call 1-800-800-8664 2) give pager #303-890-9151 3) Leave detailed message joseph_3568@msn.com		X		X	X	X	X	X			X		X
Foothills Vegetation Management Mike Wilkinson	19394 Silver Ranch Road Conifer, CO 80433	303-679-5424 (phone) 303-697-4229 (fax) wilkandson@aol.com									X				
High Timber Firewood & Logging Co. Phil & Jane Pitzer	P.O. Box 222 Nederland, CO. 80466	303-258-7942 (phone) 303-258-3179 (fax) HTFLPitzer@aol.com		X	X	X	X	X		X	X	X		X	X
Lumberjacks Logging and Firewood, Inc.	P.O. Box 547 Pinecliffe, CO. 80471	303-642-0953 (phone)		X	X	X	X	X		X		X		X	X

CONTRACTOR NAME	ADDRESS	CONTACT INFORAMATION	Consulting Forester	General Tree Cutting	Logging/ Salvage	Chipping, Slash Removal	Defensible Space	Forest/Fire Management Plans	Prescribed Fire	MPB Diagnosis & Removal	Insect, Disease, & Weed Spraying	Sawmills & Wood Processing	Fire Rehab	Wood Product Purchasing	Insured
Natalie Davidson		natalie@ionsky.com													
Morgan Timber Products Mark A. Morgan	5722 W. County Rd. 54E Bellvue, CO. 80512-7101	970-484-4065 (phone) 970-484-4065 (fax) mtpksm@hotmail.com		X	X	X	X			X		X		X	X
Mountain High Contracts Joe Phillips	P.O. Box 99 Central City, CO 80427	303-582-5052 (phone) 303-582-3990 (fax) mountainhighcontracts@earthlink.net		X	X	X	X	X		X		X		X	X
Native Ecology, Inc. Barry Bennett	P.O. Box 976 Nederland, CO. 80466	303-258-1753 (phone) barry@nativeecology.com	X	X		X	X	X		X			X		X
Natural Resource Services, Inc. Steve C. Johnson	P.O. Box 19332 Boulder, CO 80308-2332	303-915-3211 (phone) 720-652-4792 (fax) stevcj@nrsiservices.com	X			X		X							X
Olmsted Consulting Ed Olmsted	1065-B West 112 Avenue Westminster, CO 80234	(Steps 1-3 for message) 303-452-8643 (phone) edo68@aol.com	X					X							
St. Vrain Arbor Care John Robins	1361 Francis Street #B103 Longmont, CO. 80501	303-772-3136 (phone) 303-710-6065 (cell) 303-682-0399 (fax) info@stvrainarborcare.com		X			X	X		X	X		X		X
Veleta Corporation Damien Davis	P.O. Box 1329 Conifer, CO 80433	303-697-1561 (phone) 303-697-2719 (fax) veletacorp@earthlink.net		X	X	X	X								X

Fort Collins District
5060 Campus Delivery
Bldg 1052, CSU Fthis
Fort Collins, CO
80523-5060
970-491-8660
970-491-8645 fax

Colorado State FOREST SERVICE

The Colorado State Forest Service-Fort Collins District maintains this list as a service to its customers only. This list is comprised of known forest contractors that have indicated the capability and interest to offer the services listed below. The list is updated periodically for additions and changes. CSFS does not specifically recommend any of the contractors on this list. No endorsements and no representation for services are implied by the presence or absence of a possible contractor name. Please contact the contractors directly for pricing, bonding or insurance, professional qualifications, and previous customer referrals.

FORESTRY CONTRACTORS

CONTRACTOR NAME	ADDRESS	PHONE / E-MAIL / WEB SITE	Consulting/ Forest Mgt Plans	General Tree Cutting	Logging/ Salvage	Chipping, Slash Removal	Defensible Space	Fire Mitigation Plans	MPB Diagnosis & Removal	Insect & Disease Spraying	Sawmills & Wood Processing	Pile Burning	Christmas Trees/ Transplants
Advanced Forestry William K. Olsen	247 Falls Creek Dr. Bellvue, CO 80512	970-495-1719 http://www.wkolsen.com/ wkolsen@wkolsen.com	X										
Alpine Forest Mgt, LLC Scott Strickland	3912 Elmhurst Drive Fort Collins, CO 80526	cell 970-631-4672 morbark@earthlink.net	X	X		X	X	X	X	X		X	
Alpenfire, LLC. Geoff Butler	4617 Regency Dr. Fort Collins, CO 80526	970-217-8495 E-mail: gbutler@alpenfire.com	X				X	X					
Alta Tree Services Walter Chapman	P.O. Box 35 Nederland, CO 80466	303-258-0354		X	X	X	X	X	X		X		
Anchorpoint Group, LLC Rod Moraga	3775 Iris Avenue, Suite 2A Boulder, CO 80301	303-665-3473 www.anchorpointgroup.com info@anchorpointgroup.com	X					X	X			X	
Arborworks Jason Jones	400 E Hemlock Fort Collins, CO 80524	970-221-1287		X		X		X	X				
Benninghoff & Company Bruce Benninghoff	7109 W Frost Dr. Littleton, CO 80128	303-978-1264 Email benn-co@comcast.net http://benn-co.home.comcast.net	X					X					
Blue Mountain Environmental Consulting MattTobler, M.S.	937 Mallard Dr. Fort Collins, CO 80521	970-224-0851 matt_tobler@yahoo.com www.bluemountain1.net	X					X					
Brown & Associates Environmental Consultants Karl Brown		303-202-4240	X		X		X	X	X			X	
Colorado Forest Management Stefan Reinold, MS	3290 Newland St. Wheat Ridge, CO 80033	970-214-7677; coloradoforestmanagement @comcast.net; home.comcast.net/~coloradoforestmanagement	X										
Colorado Total Maintenance Joe Cordova	2240 S. Kalamath St Denver, CO 80223	303-975-9399 x12; www.coloradototal.com; ctm-ctg@coloradototal.com		X	X	X	X	X					
Colorado TreeScapes, Inc. Griff Gehring	P.O. Box 261635 Littleton, CO 80163	303-770-4155; Fax:303-248-9331 griffgehring@hotmail.com	X	X	X	X	X	X	X	X	X		X
D + D Logging Dan Barnica	14857 Left Hand Canyon Jamestown, CO 80455	303-459-3277		X		X	X	X					
Dahl Environmental Services, LLC Bjorn Dahl	23890 Genesee Village Rd Golden, CO 80401	303-526-2822; Cell: 720-560-3714; Fax: 303-526-5197 bdahl@dahlservices.com www.dahlservices.com	X					X	X				
Davey Tree and Landscape Co. Brian O'Niel	P.O. Box 1396 Boulder, CO 80306	303-449-2525 Ext-300 brian.oniel@davey.com	X	X			X	X	X				

CONTRACTOR NAME	ADDRESS	PHONE / E-MAIL / WEB SITE	Consulting/ Forest Mgt Plans	General Tree Cutting	Logging/ Salvage	Chipping; Slash Removal	Defensible Space	Fire Mitigation Plans	MPB Diagnosis & Removal	Insect & Disease Spraying	Sawmills & Wood Processing	Pile Burning	Christmas Trees/ Transplant
Double W Services, Inc. Bill Williams		303-205-1915 mbw9245@comcast.net	X					X					
Down to Earth Tree & Landscape Richard Sairow	517 Wood St. Fort Collins, CO 80521	970-472-8733		X		X	X					X	
Ecoscape Environmental Design Bill Melvin	P.O. Box 704 Boulder, CO 80306	303-447-2282; fax 303-447-8699 www.ecoscapedesign.com bill@ecoscapedesign.com	X	X	X	X	X	X	X				
EnConili Mark K. Hannon	13420 W. 58th Ave Arvada, CO 80002	303-467-3221	X		X		X	X	X			X	
Environmental Forestry Services LLC. George Hawes	P.O. Box 10,000 Suite 261 Silverthorne, CO 80498	Office: 360-733-9312; Cell: 360-739-3318; Fax: 866-227-7065 www.environmentalforestryservices.com george@environmentalforestryservices.com	X	X	X	X	X	X	X	X		X	
Fire Break Tree Service, LLC Drew Chase	307 Hawthorn Drive Loveland, CO 80538	970-581-5460, 303-431-1902 drew@firebreaktree.com; www.firebreaktree.com	X	X	X	X	X	X	X			X	
Fire Ready Tony Mahon	5201 Greenview Dr. Fort Collins, CO 80525	970-481-0814; fortcollins@fireready.com; www.fireready.com	X		X	X	X	X	X	X		X	
Fire Specialist Inc. Herman Ball	2467 N 119th St. Lafayette, CO 80026	303-665-2588	X					X					X
Firewise Landscaping Joe Turner	140 Judson St. Longmont, CO 80501	1-800-800-8664 lv message pager 303-890-9151 Joseph_3568@msn.com	X	X		X	X	X	X			X	
Firewise Forest Mgt. Inc Jeff Smith	1938 Harney St. Laramie WY, 82070	(307)760-0339 firewisejeff@gmail.com		X		X	X		X	X			
Front Range Forestry, LLC James White	P.O. Box 694 Fort Collins, CO 80522	970-224-2037, Cell: 970-222-4438 frontrangeforest@msn.com		X	X	X	X		X				
Green-Lein PGM, LLC Candace Leingang	PO Box 66 Windsor CO 80550-0066	970-686-0965, Fax: 970-686-0955 greenlein@cybersafe.net		X					X	X			
High Plains Log & Timber Greg Tyler	P.O.Box 336663 Greeley, CO 80633	cell 970-381-2775 bdogforestry@yahoo.com					X	X					
High Timber Firewood and Logging; Phil & Jane Pitzer	P.O. Box 222 Nederland, CO 80466	303-258-7942, Fax: 303-258-3179 www.high-timber.com HTFLPitzer@aol.com		X	X	X	X	X	X				
Land Stewardship Associates, LLC Donnie Sparks	P.O. Box 1904 Canon City, CO 81215-1904	719-275-0992 donniesparks@bresnan.net www.landstewards.net	X				X	X					
Long, Keith	13031 WCR 88 Pierce,. CO 80650	970-420-1917 cell 970-834-1184 home		X	X	X	X						
Lumberjacks Logging & Firewood, Inc.; Jack Davidson	P.O. Box 646 Pinecliffe, CO 80471	303-642-0953 www.lumberjacksbest.com natalie@ionsky.com	X	X	X	X	X	X	X				
Mike's Tree Service Adam Strong	PO Box 4420 Estes Park, CO 80517	970-586-7546		X		X	X		X				
MK Services Mark Phipps	14700 North Couty Road 7 Wellington, CO 80549	970-568-9211		X		X	X		X				

CONTRACTOR NAME	ADDRESS	PHONE / E-MAIL / WEB SITE	Consulting/ Forest Mgt Plans	General Tree Cutting	Logging/ Salvage	Chipping; Slash Removal	Defensible Space	Fire Mitigation Plans	MPB Diagnosis & Removal	Insect & Disease Spraying	Sawmills & Wood Processing	Pile Burning	Christmas Trees/ Transplant
Morgan Timber Products Mark Morgan	2532 W. County Rd. 54G Fort Collins, CO 80524	970-484-4065; 970-224-3877 mtpksm@hotmail.com	X		X	X	X	X	X		X		
Natural Resource Consultants James E. Ficke	PO Box 3418 Steamboat Springs, CO 80477	970-879-8319	X					X				X	
Nix, Tim	320 East Plum, Apt B Fort Collins, CO 80524	970-846-7309		X	X	X	X	X	X			X	
Oberle Envtl. Services Matthew & Sue Oberle	832 Timber Ln. Fort Collins, CO 80521	970-493-5672	X										
Rocky Mountain Tree Services Mark Berard	PO Box 1334 Loveland, CO 80539	970-225-9596		X									
S. Edwards Inc Sally Edwards	442 Truman Dr. Fort Collins, CO 80525	970-593-0501	X	X			X	X	X				
Short Forestry LLC Bruce Short	40 Chico Camino St. Monte Vista CO 81144	719-852-0552; Cell: 303-819-6901 www.shortforestry.com stumpjumper@bresnan.net	X					X					
St. Vrain Arbor Care John Robbins	1361 Francis St. Longmont, CO 80501	303-772-3136, Fax: 303-682-0399 www.stvrainarborcare.com info@stvrainarborcare.com	X	X	X	X	X	X	X				
Steve's Tree and Chimney Service Steve Suchoki	12933 Appaloosa Ave. Wellington, CO 80549	970-568-3181 Cell: 970-481-9629	X	X	X	X	X	X	X				
Swingle Tree, Lawn & Landscape Care	1805 E Lincoln Ave. A3 Fort Collins, CO 80524	970-221-1287 www.swingletree.com		X		X	X		X	X			
Timberscapes Brad Crawford	38568 WCR 13 Fort Collins, CO 80524	970-224-3005, Cell: 970-443-1733 mtnjem@msn.com		X		X	X						
Timberwolf Enterprise Rich Palestro	311 Warrick St. Frederick, CO 80530	303-775-6585		X	X	X			X			X	
United Wood Products Inc. Raul & Fred Bustamante	7860 Diagonal Hwy. Longmont, CO 80503-8760	303-652-2872, Fax: 303-652-2286 unitedwoodproductsinc.com									X		
Waterwise Landscaping Chris Meglen	919 Kingston Dr Fort Collins, CO 80525	970-402-7428				X							
West Range Reclamation, LLC Cody Neff	36702 Fruitland Mesa Rd Crawford, CO 81415	970-921-5460 Fax 970-921-5461 cody@westrangereclamation.com www.westrangereclamation.com	X	X	X	X	X	X	X			X	
Wildland Fire Associates Matthew Scoggins	118 West Main St Rangely CO 81648	970-675-2225, Fax: 970-675-2220 steve@wildlandfireassociates.com					X	X				X	
Woodland Mangement Bill Gherardi	P.O. Box 10 Fort Collins, CO 80522	970-221-1336 billgherardi@comcast.net	X						X				
Work-A-Haulics, Inc	820 E. County Rd. 58 Fort Collins, CO 80524	970-484-0888 work_a_haulics@msn.com		X		X	X					X	

FRANKTOWN DISTRICT CONTRACTOR LIST

The Colorado State Forest Service-Franktown District maintains this list as a service to its clients only, and makes no representations for the services provided by the individuals or firms included on this list.

This list is comprised of known forest contractors in the Franktown District area (Douglas, Elbert, Lincoln, and E. Arapahoe Counties) that have indicated an interest or capability to offer the services stated below. This list is updated as conditions or changes to the available contractor base occur.

Please contact the contractors directly for pricing, bonding or insurance, professional qualifications, and previous customer referrals. CSFS does not specifically recommend or endorse any contractors on this list.

This list is provided as a local directory only, and no endorsements are implied by the presence or absence of a possible contractor's name. **You should always ask for proof of current commercial licensing of any spray applicator by the State of Colorado's Department of Agriculture.**

TREE SPRAY SERVICE CONTRACTORS Current as of: July 3, 2007

Name	Address	Phone Number
A-1 Tree Service	7733 S. Ames Way Littleton, CO 80128	(303) 933-4811
American Tree	17355 W. 57th Avenue Golden, CO 80403	(303) 456-6898
Arbor Pro Tree Experts Co. Inc	6405 W. Mississippi Ave. Lakewood, CO 80226	(303) 935-0005 West office (303) 759-1116 East office
Arborist Arms Tree Co.	6360 S. Kendall Littleton, CO 80123	Ph. (303) 738-1999 Fax (303) 738-9978
C Lazy T Spraying Service	11527 East Smith Road Elbert, CO 80106	(303) 660-9662 office (303) 475-7534 cell
Integrated Lawn and Tree Care	3108 Beacon Street Colorado Springs, CO 80918	(719) 528-5296 Website: www.healthylawn.net
Quality Tree Service Inc.	2640 W. Union Ave. Englewood, CO 80110	(303) 798-4773
Rocky Top Resources Scott Piggot	1755 E. Las Vegas Street Colorado Springs, CO 80903	(719) 579-9103
Shady Tree and Lawn Service	11348 E. Oxen Road Parker, CO 80138	(303) 805-8497
Swingle Tree and Landscape Care	8585 E. Warren Ave. Denver, CO 80203	(303) 306-3123
T-P Enterprises	5055 E. 39 Ave. Denver, CO 80203	(303) 377 1215
TruGreen ChemLawn	12445 Dumont Way Littleton, CO 80122	(303) 791 1444
Wilhelm-Davey Tree & Lawn Care	2000 S. Quebec St. Denver, CO 80231	(303) 750-9273

TREE SERVICE COMPANIES IN LINCOLN/E. ARAPAHOE COUNTIES

Name	Address	Phone Number
Crimson Tree Service	35850 Wagner Lane Calhan, CO 80808	(719) 541-2650
Green Horizons Turf and Tree Care Ltd.	429 Loveland Ave. Flagler, CO 80815	(719) 765-4321
Vision Services Thomas Stoumbaugh	P.O. Box 15 Deer Trail, CO 80105	(303) 769-4761 (720) 281-2361 or *2362

LANDSCAPE ARBORISTS, TREE PRUNING & REMOVAL COMPANIES

Name	Address	Phone Number
Arbor Pro Tree Experts Co. Inc	6405 W. Mississippi Ave. Lakewood, CO 80226	(303) 935-0005 West office (303) 759-1116 East office
Arborist Arms Tree Co.	6360 S. Kendall Littleton, CO 80123	(303) 738-1999
C Lazy T Spraying Service	11527 East Smith Road Elbert, CO 80106	(303) 660-9662 office (303) 475-7534 cell
Integrated Lawn and Tree Care	3108 Beacon Street Colorado Springs, CO 80918	(719) 528-5296 Website: www.healthylawn.net
Quality Tree Service Inc.	2640 W. Union Ave. Englewood, CO 80110	(303) 798-4773
Rocky Top Resources Scott Piggot	1755 E. Las Vegas Street Colorado Springs, CO 80903	(719) 579-9103
Shady Tree and Lawn Service	11348 E. Oxen Road Parker, CO 80138	(303) 805-8497
Swingle Tree and Landscape Care	8585 E. Warren Ave. Denver, CO 80203	(303) 306-3123
The Tree Guy Sean T. Searle	2565 Burnt Oak Dr. Franktown, CO 80116	(303) 521-6717
TruGreen ChemLawn	12445 Dumont Way Littleton, CO 80122	(303) 791 1444
Wilhelm-Davey Tree & Lawn Care	2000 S. Quebec St. Denver, CO 80231	(303) 750-9273

FIRE MITIGATION, FUELS REDUCTION & REMOVAL COMPANIES

Name	Address	Phone Number
Firestorm Wildland Mitigation, LLC Keith Long & Rob Leonard		(303) 646-2192 Keith (720)219-3336 cell Rob (303) 717-8592 cell
FireWise Colorado Susan Oliver	P.O. Box 242 Larkspur, CO 80118	(303) 681-0880
Horticare Greg Eno	7160 Alpenwood Way Colorado Springs, CO 80918	(719) 593-9610 (719)440-4649 cell
Horton Ground Control, LLC Chris Horton	P.O. Box 194 Larkspur, CO 80118	(303) 681-0541 (303) 589-1771 cell
Rampart Fire Services, LLC Denny Van Why	905 Bowstring Road Monument, CO 80132	(719) 481-1665 office (720) 235-9867 cell
Rampart Landscape and Arbor Service	P.O. Box 343 Castle Rock, CO 80104	(303) 681-2085 (719) 488-8817
Rocky Top Resources Scott Piggot	1755 E. Las Vegas Street Colorado Springs, CO 80903	(719) 579-9103
The Tree Guy Sean T. Searle	2565 Burnt Oak Dr. Franktown, CO 80116	(303) 521-6717
Tree Masters John Psensky	P.O. Box 3249 Monument, CO 80132	(719) 492-8129
Twisted Timber Russell Graves and sons	4313 E. Bennington Ave. Castle Rock, CO 80104	(303) 814-1172
Fire Ready Andrew Notbohm	845 E. Kiowa Street Colorado Springs, CO 80903	(719) 659-3383
Colorado Total Maintenance Joe Cordova, Vice President	P.O. Box 118 Englewood, CO 80151	Ph. (303) 975-9399 Fax (303) 975-1323

APPENDIX II – MANUFACTURER'S STUDIES

Prepared by: Mike Schmidt
Manager, Forestry Renewables
John Deere Construction & Forestry
563-340-2471
SchmidtJamesM@JohnDeere.com

- MACHINE COST ANALYSIS -

DEALER : Any
MACHINE: 1490D Eco III Energy Harvester
DATE: June 2008
Prepared by:

GENERAL MACHINE INFORMATION:

1.	Machine life (Years)	5	
2.	Scheduled hours per shift	10	
3.	Shifts per day	1	
4.	Operating days per year	200	
5.	Mechanical availability (%)	85.0	
6.	Operational utilization (%)	85.0	
7.	Efficiency factor (%), (PMH/SMH)	72.3	(5) * (6)
8.	Scheduled machine hours / year (SMH)	2,000	(2) * (3) * (4)
9.	Productive machine hours / year (PMH)	1,445	(8) * (7)
10.	Useful life of machine (PMH)	7225.0	(1) * (9)

FIXED COST:

Capital cost information:

11.	Purchase price, delivered		$550,000	
12.	Salvage value at end of life (%)		20	
13.	Interest rate (%)		6.00	
14.	Salvage value at end of life		$110,000	(11) * (12)
15.	Depreciated amount		$440,000	(11) - (14)
	Capital Recovery Depreciation, CRD (includes interest cost):			: CRD = ((15)*CRF) + ((14)*(13))
				: CRF = Capital Recovery Factor =
16.		($/year)	$111,054	: (13)*(1+(13))^(1) / (1+(13))^(1)
17.		($/PMH)	$76.85	(16) / (9)

Machine licensing and insurance:

18.	License ($ per year)	$0	
19.	Insurance (% of purch., per year)	1.5	
20.	Insurance ($ per year)	$8,250	(11) * (19)
21.	License and insurance ($/PMH)	$5.71	((18) + (20)) / (9)

22.	**TOTAL FIXED COST:**	**($ per year)**	**$119,304**	(16) + (18) + (20)
23.		**($ per month)**	**$9,942**	(22) / 12
24.		**($/PMH)**	**$82.56**	(22) / (9)

VARIABLE COST:

Machine variable cost:

25. Service and repair (mat. and labour) over useful life (% of deprec. amount)	65	
26. Fuel consumption (Units/PMH)	3.0	
27. Fuel cost per unit	$4.50	
28. Hyd. oil & lube cost ($/PMH)	$2.52	30% of fuel
29. Service and repair cost for life	$286,000	(25) * (15)
30. Service and repair cost ($/PMH)	$39.58	(29) / (9)
31. Fuel cost ($/PMH)	$13.50	(26) * (27)
32. Total machine variable cost ($/PMH)	**$55.60**	(28) + (30) + (31)

Operator cost:

33. Operator wages ($/SMH)	$15.00	
34. Fringe benefits (% of wages)	35.0	
35. Total operator cost: ($/SMH)	$20.25	(33) * (1 + (34))
36. ($/PMH)	**$28.03**	(35) / (7)

37. TOTAL VARIABLE COST ($/PMH)	**$83.63**	(32) + (36)

38. TOTAL OPERATING COST ($/PMH)	**$166.20**	(24) + (37)

PRODUCTION DATA:	**LOW**	**AVERAGE**	**HIGH**	
39. Productivity (bundles per hour)	15	25	35	
40. Cubic unit type (.5 bundles)	0.6	0.6	0.6	
41. Bundles per 'unit' (ton)	2.0	2.0	2.0	
42. Productivity ('units'/PMH)	7.50	12.50	17.50	(39) / (41)
43. Production per year (units)	10,838	18,063	25,288	(42) * (9)

44. TOTAL OPERATING COST:	**per 'ton'**	**$22.16**	**$13.30**	**$9.50**	(38) / (42)
					(44) / 0.415
					(44) / 0.353
					(44) / 0.208

NOTICE: The above calculations are based on information believed to be reliable. However, since the end use of the product is beyond the control of the manufacturer and dealer, WE DO NOT GUARANTEE THE RESULTS TO BE OBTAINED.

Small changes in tree size, operator motivation, operational utilization and mechanical availability have significant effect on the machine performance and profitability. ALL THESE FACTORS ARE OUTSIDE OF THE CONTROL OF THE MANUFACTURER AND DEALER.

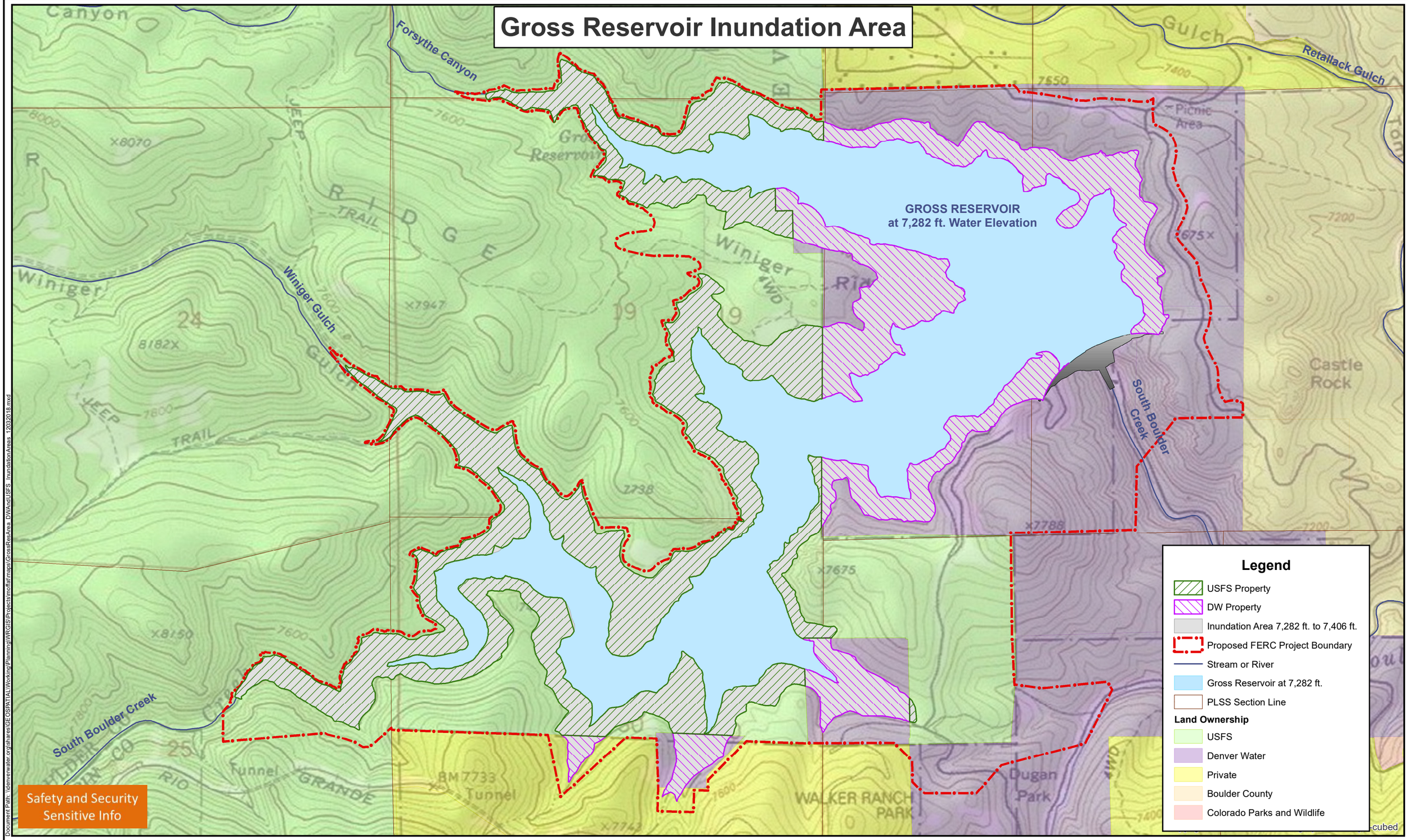
APPENDIX B – Figures

Gross Reservoir Inundation Area Figure

and

General Location of Fuel Break Activities Figure

Gross Reservoir Inundation Area



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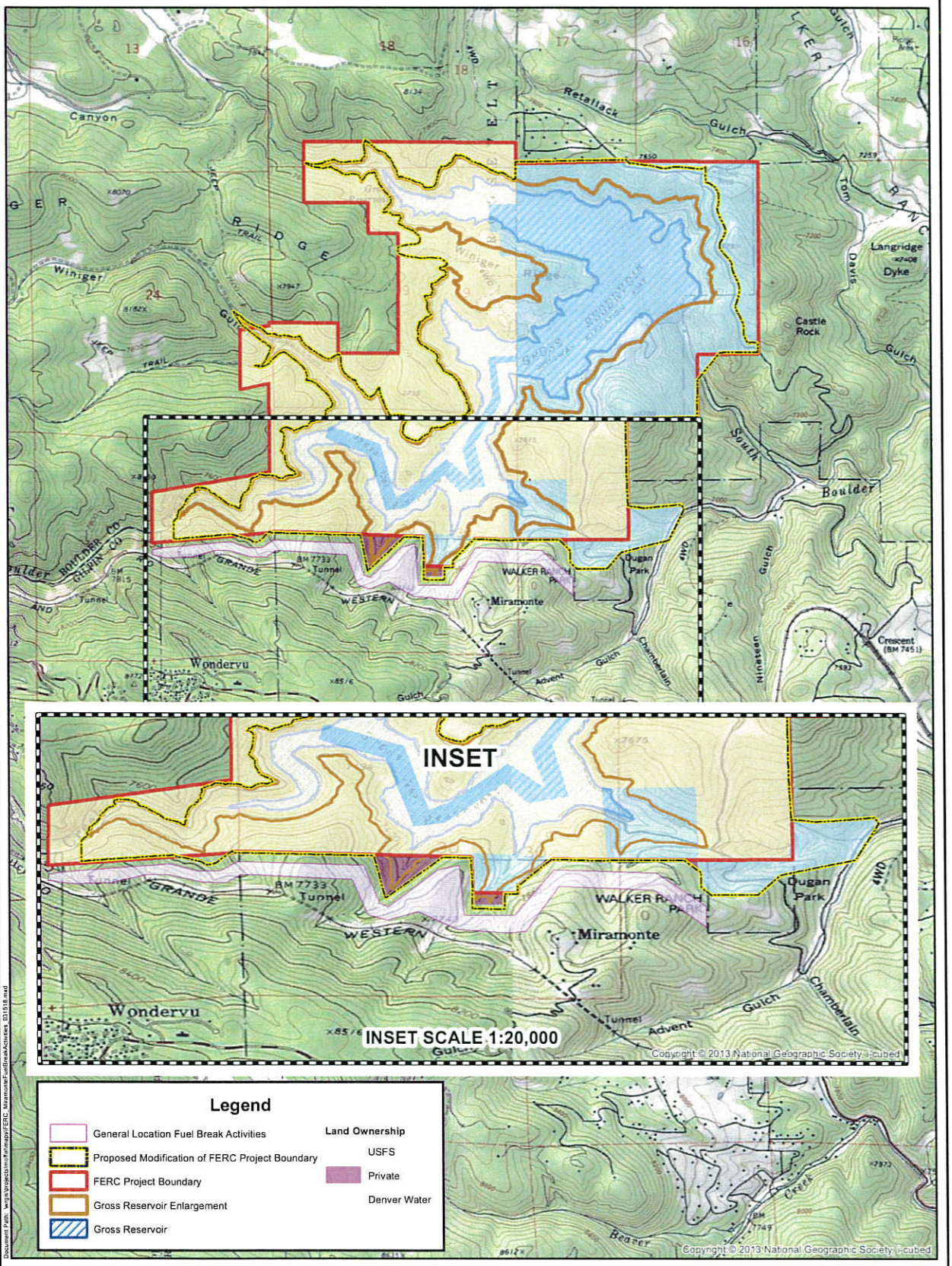
Map Date: 12/03/2018
Author: Denver Water GIS - TKT
Sources: DW, USFS, USGS, COMaP

General Location of Fuel Break Activities at Gross Reservoir



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Miles

N

1:24,000

Land Ownership compiled by the Natural Resources Ecology Lab (NREL) at Colorado State University, Fort Collins, CO as COMaP v.7.

Theobald, D.M., G. Wilcox, S.E. Linn, N. Peterson, and M. Lineal. 2008. Colorado Ownership, Management, and Protection v7 database. Human Dimensions of Natural Resources and Natural Resource Ecology Lab, Colorado State University, Fort Collins, CO. 15 September. www.nrel.colostate.edu/projects/comap

DENVER WATER

Map Date: 03/15/2018
Author: Denver Water GIS - TKT

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