RECLAMATION

Managing Water in the West

Windy Gap Firming Project

Visual Assessment Technical Report

U.S. Department of the Interior
Bureau of Reclamation
Great Plains Region

July 2008

Visual Assessment Technical Report

Windy Gap Firming Project

Prepared for:

U. S. Bureau of Reclamation
Eastern Area Office
Loveland, Colorado

July 2008

Prepared by:

Holdeman Landscape Architecture
1842 Clarkson Street
Denver, Colorado 80218
(303) 830-1188

and

ERO Resources Corporation
1842 Clarkson Street
Denver, Colorado 80218
(303) 830-1188

CONTENTS

Tables

Figures

Appendices

WINDY GAP FIRMING PROJECT
VISUAL ASSESSMENT TECHNICAL REPORT

INTRODUCTION

The Bureau of Reclamation (Reclamation) has received a proposal from the Municipal Subdistrict, Northern Colorado Water Conservancy District, acting by and through the Windy Gap Firming Project Water Activity Enterprise (Subdistrict) to improve the firm yield from the existing Windy Gap Project water supply by constructing the Windy Gap Firming Project (WGFP). The proposal includes a connection of WGFP facilities to the Colorado-Big Thompson Project (C-BT). For more information on the background and purpose of the WGFP, see the Windy Gap Firming Project Purpose and Need Report (ERO 2005a). This technical report was prepared to address the potential environmental effects on visual quality associated with the alternatives described below, and will be used in the preparation of the EIS.

ALTERNATIVES

The Windy Gap Firming Project Alternatives Report (ERO 2005b) identified four action alternatives in addition to the No Action alternative for evaluation in the EIS. All action alternatives include development of 90,000 AF of new storage in either a single reservoir on the East Slope or a combination of East and West Slope reservoirs. The Subdistrict's Proposed Action is construction of a 90,000 AF Chimney Hollow Reservoir with prepositioning. The alternatives are:

- Alternative 1 (No Action)—Continuation of existing operations and agreements between Reclamation and the Subdistrict for conveyance of Windy Gap water through the Colorado-Big Thompson facilities, including the enlargement of Ralph Price Reservoir by the City of Longmont
- Alternative 2 (Proposed Action)—Chimney Hollow Reservoir (90,000 AF) with prepositioning
- Alternative 3—Chimney Hollow Reservoir (70,000 AF) and Jasper East Reservoir (20,000 AF)
- Alternative 4—Chimney Hollow Reservoir (70,000 AF) and Rockwell/Mueller Creek Reservoir (20,000 AF)
- Alternative 5—Dry Creek Reservoir (60,000 AF) and Rockwell/Mueller Creek Reservoir (30,000 AF)

Detailed descriptions of the components and operation of the alternatives is included in the Draft Windy Gap EIS Alternatives Descriptions Report (Boyle Engineering 2005).

STUDY AREA

The study area includes each of the four potential new reservoir sites and the enlargement of Ralph Price Reservoir under the No Action alternative. In addition, the study area includes land within a 2.5-mile radius of the reservoir sites that could potentially have a view the dams, reservoirs, roads, pipelines, and facilities (Figure A-1).

VISUAL ASSESSMENT METHODS

Holdeman Landscape Architects (HLA) developed the approach to the visual assessment based on the Visual Prioritization Process (VPP) (FHWA 1994) and previous HLA visual assessments. The visual assessment considered scenic quality and the visibility of alternative dam and reservoir sites from key observation points. Thus, the visual quality assessment for the existing and alternative new dam and reservoir locations consists of two separate assessments:

- A scenic quality assessment evaluated the existing scenic quality in the study areas. This portion of the assessment is a field measurement of the physical characteristics or elements of scenic quality. These elements include land form types, rock form types and sizes, water form types, artificial form types and quantities, the size of the field of view (referred to as containment), and the color and texture variations. Scenic quality elements have rating scales with high values indicating high scenic quality.

- A line-of-sight/viewshed analysis, called a visibility study, identified areas with views of the alternative dams and reservoirs. Digital terrain modeling and the projected location of the reservoir and dam was used to identify locations from which the reservoir/dam would be visible. Visibility elements have rating scales with high values indicating high visibility.

SCENIC QUALITY ELEMENTS

Land Form
Rock Form
Water Form
Artificial Form
Containment
Color and Texture

Scenic Quality Assessment

Scenic quality was determined by measuring six scenic quality elements within a defined visible region directed toward the alternative reservoir and dam location. In the study area, these elements are land forms, rock forms, water forms, the presence of man-made changes or artificial forms, obstructions to views creating containment, and color and texture changes.

Each scenic quality element was divided into evaluation components, and a numeric value ranging from 0 to 3 was assigned to each component. The value of 3 represented the highest quality of the element and 0 represented the lowest. For example, the land form element was divided into the components of summit, mountain, hill,

and level. Because summits are mountaintops that dominate the landscape, the summit component was assigned a value of 3. Level or nearly level areas that offered no contrasting topographic changes were assigned a value of 0.

The scenic quality element was rated in the field during the summer and fall of 2005 from key observation points (KOPs). KOPs primarily were roads, highways, recreational facilities, commercial lands, residences, and historic sites where people currently are present. Other locations may have a better view of the reservoir/dam sites, but there is currently no development or limited use or access.

Land Form

Land forms are surface features of the Earth's crust such as mountains, valleys, and plains. A land form is considered dominant in a view if it 1) consumes a large portion of the view, or 2) possesses strong contrasting characteristics and/or is positioned directly in front of the viewer. For example, summit topography possesses strong contrasting characteristics with the sky and land forms below. The visibility of mountain summits is also more unusual than other land forms. Conversely, near level and flat topography is generally more uniform in slope and shape. Level land forms typically do not attract visual attention (Table 1).

Table 1. Land form values.

Value	Component	Description
3	Summit	Mountaintops with dominant vertical and steep slopes
2	Montane	Mountains with variety in topography, vegetation, and water features
1	Hill	Moderately concave or convex, gently sloped topography such as Front Range foothills
0	Level	Predominantly flat or nearly level with no contrasting changes in topography

Rock Form

Rock forms are exposed native rock or rock formations. Rock forms in the landscape substantially increase visual variety. In the study area, rock forms include isolated outcrops, prominent fields of boulders, and entire land forms composed of rock. A rock form contrasting with surrounding land and water surfaces is a prominent visual feature (Table 2).

Table 2. Rock form values.

Value	Component	Description
3	Outcrop	Entire land forms of exposed solid or loose rock
2	Vegetated outcrop	Outcrops partially covered with soil and vegetation
1	Boulders	Boulders on, or partially in the ground surface
0	Absent	No visible rocks or rock masses

Water Form

Water forms are surface water features such as lakes and streams, and wetlands with or without surface water. The presence of water provides visual compliment or contrast to the surrounding landscape. The greater contrast a water feature creates, the greater the visual attention. To measure the scenic quality of water features in the study area, only permanent water forms were assessed (Table 3).

Table 3. Water form values.

Value	Component	Description
3	Vertical	Waterfalls or vertical snow banks
2	Horizontal in motion	Streams or rivers
1	Horizontal stationary	Wetlands, lakes, ponds, ice, or snow
0	Absent	No visible forms of water

Artificial Form

Artificial forms are those created by humans. In the study area, artificial forms include buildings, signs, guardrails, roads, and resultant land forms from previous earthwork. In the study area, the contrast created by artificial forms typically detracts from a view (Table 4).

Table 4. Artificial form values.

Value	Component	Description
3	Absent	No visible man-made forms
2	Unobtrusive	Artificial form is visible, but not obtrusive due to size, location, or form
1	Distractive	Artificial form distracts from view by size, location, or contrast
0	Dominant	Artificial form dominates view by size or contrast

Containment

Containment diminishes a feature's visibility because it eliminates parts of a view by reducing the width and length of the view. As containment increases, visual variety typically decreases. A completely unobstructed view has the potential for possessing the greatest variety of elements for the viewer, while a contained view typically has the least variety of elements (Table 5).

Table 5. Containment values.

Value	Component	Description
3	Absent	No visual obstructions to any horizon or distant objects
2	Partial	Less than one-half of the horizon or distant objects are obscured
1	Enclosed	More than one-half of the horizon or distant objects are obscured
0	Complete	Horizon or distant objects are completely obscured

Color and Texture

Color and texture are defining elements in the visible landscape. Visual perception of distant forms is a result of color variations. Forms are enhanced by the presence of colors and visible texture and diminished by their absence. Conversely, colors and textures in most of a montane forest tend to be consistent and unchanging (Table 6).

Table 6. Color and texture values.

Value	Component	Description
3	Variety	Variations in color and texture throughout entire view
2	Coexistence	Variations in color and texture within a portion of view
1	Consistency	Unvaried appearance of surface or pattern
0	Monotony	No visible variation

VISIBILITY ELEMENTS

Distance
View Angle
View Amount

Visibility Assessment

The visibility assessment includes a line-of-sight viewshed analysis to identify areas where the alternative dam and reservoir locations would be visible from surrounding lands. View blocking effects of topography were simulated using digital elevation data. The distance and angle between observation points and the dam and reservoir locations also were considered in the analysis. View angles were related to the elevations of the top of the dams. KOPs were determined by locating points representative of the views from roads, highways,

commercial areas, recreation areas, and residences within 2.5 miles of the reservoir sites.

The NCWCD prepared the visibility study maps for each of the alternative dam and reservoir locations, in cooperation with HLA, according to the procedures described below. HLA developed the study criteria and map formats for the visibility study. Dam and reservoir locations and elevation information was provided by Boyle Engineering Corporation in Lakewood, Colorado.

The first step in the visibility analysis was to acquire the three datasets: 1) the reservoir and dam locations and elevations (Boyle Engineering 2005); 2) the elevation of the study area (National Elevation Dataset (NED)) with a 10-meter cell size (TerraServer 2005); and 3) detailed 1-meter color aerial photography for the Chimney Hollow and Dry Creek sites (I Cubed 2003). Imagery for the Rockwell/Mueller and Jasper sites was 1990 1-meter black and white National High Altitude Program (NHAP) photography (TerraServer 2005). All data was then transformed and/or projected to Colorado State Plane North Zone (fips code 501), North American Datum (NAD 1983), linear units of feet.

The dam outlines were then divided into thirds (resulting in three polygons) and assigned an elevation that corresponded to the polygon's relative position on the dam face. A fourth polygon was created for the dam crest and assigned the dam maximum elevation. The reservoir polygon was assigned the elevation associated with that scenario. The NED data was then altered so that the proposed reservoir and associated dam elevation values were correctly portrayed by the NED dataset. The four data sets (reservoir and dam polygons) were combined and then buffered to 300 feet, 0.5 mile, and 2.5 miles.

A grid of points was then generated that placed a point every 50 meters within the area defined by the reservoir and dam(s). An analysis procedure was then used by which every cell in the defined area of interest for the defined reservoir was assigned a value that corresponded to the number of reservoir/dam points that were visible from that particular cell. The resulting dataset then identified all cells that were visible from the reservoir/dam as well as a qualitative measure of how much of the reservoir/dam was visible from that particular cell. This data set was then separated into two datasets: 1) those cells that were equal to or above the elevation of the reservoir; and 2) those cells that were below the reservoir elevation. The above and below data sets were then further separated into four categories: 1) more than 90 percent of reservoir/dam visible; 2) between 50 and 90 percent visible; 3) less than 50 percent visible; and 4) reservoir/dam not visible.

A map was then created that showed the area where the reservoir/dam would be visible from surrounding lands (Figures B-1 to E-1). Areas above the reservoir elevation with views of the reservoir/dam are shown in shades of yellow (the darker the yellow, the more

reservoir/dam can be seen), and areas where only the dam is visible are shown in red.

Tree and Building Effects on Visibility

The screening effects of individual trees, tree masses, and buildings were observed in the field for each KOP. Varying degrees of screening effects would partially or completely obscure some alternative dam and reservoir views not indicated in the line-of-sight analyses. Screening effects would diminish or eliminate (dependent upon the amount of screening) the visual impacts of the alternative dam and reservoir.

Distance Ratings

The visual impacts of the potential dams and reservoirs vary with the observation distance (Table 7). To estimate this impact, three distance zones were created: 1) an "evident" zone, from 0 to 300 feet away from the alternative dam and reservoir; 2) an "identifiable" zone, from 301 feet to 0.5 mile; and 3) a "perceptible" zone from 0.5 mile to 2.5 miles. These distance zones were selected by viewing the alternative dam and reservoir locations and their visual effects from the KOPs, and applying the USDA Forest Service viewing distance zones defined in Handbook A701, A Handbook for Scenery Management. In the "evident" zone of a dam and reservoir, details of facilities, vehicles, and persons would be readily apparent. The size of these items is proportionally large in most views. In the "identifiable" zone, details of the reservoir and dam diminish to recognition only of the objects being viewed. In the "perceptible" zone, the presence of a road or dam is not apparent due to the absence of details and the relatively small size of the object within a view. The dam and reservoirs would not typically be the largest subjects within the view from this zone (Table 7).

Table 7. Distance values.

Value	Component	Description
2	Evident	0 to 300 feet; details of lake and dam, including water surface conditions, persons, and vehicles, clearly recognizable
1	Identifiable	301 feet to 2,640 feet (0.5 mile); lake and dam components identifiable, yet size is diminishing significantly in view
0	Perceptible	2,640 feet (0.5 mile) to 21,120 feet (2.5 miles); lake and dam components visible, yet approaching insignificant due to small size

Angle Ratings

The visual impacts of the proposed dams and reservoirs vary with the observation angle (Table 8). To evaluate this impact, two angle zones

were created: 1) a zone below the elevation of the top of the dam; and 2) a zone above the elevation of the top of the dam. Only the face of the dam would be visible to observation points below the elevation of the top of the dam. These observation points would not be able to see any surface water within the reservoir. Therefore, these views would be dominated only by the artificial form of the dam without any beneficial views of the water. Alternatively, the observation points above the elevation of the top of the dam would benefit from dominant views of the water and either no views or minimal views of the artificial form of the dam.

Table 8. View angle values.

Value	Component	Description
1	Below	Dominant view of face of dam with no view of surface water in reservoir
0	Above	Dominant view of surface water in reservoir with no view or minimal view of face of dam

Amount Ratings

The visual impacts of the dam and reservoir sites vary with the amount of visibility (Table 9). To evaluate this impact, three amounts of visibility were created: 1) no amount of dam or reservoir would be visible; 2) 1 percent to 50 percent of the points representing the dam or reservoir would be visible; and 3) 51 percent to 100 percent of the points representing the dam or reservoir would be visible. Views including a majority of the dam or reservoir points (more than 50 percent) could be dominated by the dam or reservoir dependent upon the observation point distance.

Table 9. View amount values.

Value	Component	Description
2	Majority	View of 51% to 100% of points representing the dam or reservoir
1	Minority	View of 1% to 50% of points representing the dam or reservoir
0	Nonexistent	Neither dam nor reservoir would be visible

Ratings and Categories

After each scenic quality element was evaluated, field measurements were recorded onto spreadsheets. The values for all elements at each KOP were summed. The summed values then were plotted on a cumulative frequency plot to determine groupings of the values. The ranges of the value groupings for all reservoir study areas were

averaged to establish numerical values for three categories (low, moderate, and high) (Table 10). The visibility elements were similarly evaluated to establish the same categories.

Table 10. Rating values.

Assessment/Analysis	Low	Moderate	High
Scenic Quality	0 - 7	8 - 10	11 - 16
Visibility	0	2	5

The groupings of values identified in the cumulative frequency plots associate the low, moderate, and high categories directly with the landscape characteristics (scenic quality elements) of the alternatives' geographic locations. In this manner, these categories are not comparing the landscape characteristics of the alternatives' locations with substantially different locations. For example, the dominant mountainous land forms and rock forms of these study areas are not visible or present in everglade locations common in the southeastern United States. Therefore, study areas with substantially different regional landscape characteristics are not compared.

The appendices include all field measurements and the cumulative frequency plots.

The visible variety, size, and contrast of scenic quality elements either contribute to, or distract from scenic quality. A view with much variety typically maintains and enhances viewer interest by eliminating possible visual monotony. Dominance or recession of a characteristic is frequently determined by its size within a view. A characteristic's contrast or complement with its surroundings may create a visual attraction or distraction. In the case of water features, where there is greater contrast, there is greater visual attraction and enhancement of scenic quality. With artificial forms such as dams and road cuts, greater contrast typically distracts from scenic quality.

AFFECTED ENVIRONMENT

A description of the visual quality for each of the potential reservoir sites and the existing Ralph Price Reservoir is provided below. Figure A-1 shows locations of the five alternative reservoirs and their respective study areas.

Jasper East Reservoir

The Jasper East study area is characterized by a large open valley with hills, and in the distance, mountain ranges are visible. The valley is mostly covered with grasses, forbs, and low-growing shrubs, with some isolated areas of evergreen and deciduous forest. The distant mountain ranges are forested with peaks and ridges visible above timberline. Within the study area, a few gravel roads and some houses are visible

as the only land development. The houses are located west and south of the reservoir and facilities location.

The overall scenic quality of the Jasper East study area is high. Some views in this study area are from Willow Creek Reservoir in Arapaho National Recreation Area (ANRA). Visible artificial forms from the ANRA and a portion of U.S. 34 are limited to two-lane roads, low wire fences, distant houses, and the Willow Creek Feeder Canal forebay (KOPs 5 through 8, Figure B-1). Most views from all KOPs of the reservoir site are unobstructed and extend to mountainous horizons. Views of the reservoir site from homes and roads south of the Jasper East Reservoir site (KOPs 1 through 4, Figure B-1) are characterized by forested areas partially or completely obscuring views to the mountain horizons. The scenic quality of views of the reservoir site from residences in the study area, represented by KOP 11 (Figure B-1), is high. These single-family homes are located in the westernmost portion of the study area and have views of Willow Creek Reservoir, areas of isolated forests, and rock peaks and ridges of distant mountain ranges. Lower in the valley along gravel roads (KOPs 9, 10, and 12, Figure B-1), the scenic quality is moderate. Views of distant mountain ranges are partially or completely obscured by forested areas and hills. However, there are minimal artificial forms from these KOPs to distract from views within the valley.

The scenic quality of the Jasper East Reservoir site within the study area is high. This location is characterized by undisturbed hills covered predominantly with low-growing vegetation and isolated areas of evergreen and deciduous forest.

Rockwell/Mueller Creek Reservoir

The Rockwell/Mueller Creek Reservoir study area is characterized by a large, open, valley with hills and forested mountains in the distance. The hills in the valley are mostly covered with grasses, forbs, and low-growing shrubs. The distant mountain ranges are mostly forested. The Colorado and Fraser rivers and multiple creeks and streams run through the valley. Within the study area, many residential, commercial, and recreational land developments exist. In the northeast quadrant of the study area is the town of Granby.

The overall scenic quality of the Rockwell/Mueller Creek Reservoir study area is moderate. Although most views in this study area are unobstructed and extend to mountainous horizons, a large quantity of artificial forms, such as overhead utilities, railroad facilities, commercial buildings, gravel parking areas, and highway facilities exist within the foregrounds of all views of the reservoir site from Granby (KOPs 1 through 7, Figure C-1) and some views of the reservoir site from roads and highways (KOPs 6, 7, and 11, Figure C-1). These locations have low scenic quality. However, some road, highway, and recreation facility views of the reservoir site (KOPs 8, 9, and 10, Figure C-1), and some residential area views of the reservoir site (KOPs 13

through 18, Figure C-1) have high scenic quality. The high scenic quality areas are characterized by the absence, or minimal presence, of artificial forms with few obstructions to block views. These high scenic quality views also possess variety in land forms, rock forms, and color and texture. KOPs with the highest scenic quality also have unobstructed views of a large variety of sky conditions, typically cloud formations. This scenic quality characteristic quantitatively increases the variety of color and texture, and qualitatively increases the variety of natural subjects in a view.

The scenic quality of the Rockwell/Mueller Creek Reservoir site within the study area is high. This location is characterized by undisturbed hills with low-growing vegetation, the Fraser River lined with cottonwoods and willows, and some exposed rock outcrops.

Dry Creek Reservoir

The Dry Creek study area is characterized by a large open valley with foothills-type land forms, rock outcrops, rocky mesas, scattered evergreen trees, a single creek in the valley bottom, and some cultural resources such as small rural outbuildings, stone foundations, and roads. The hills in the valley are covered with grasses, forbs, low-growing shrubs, and scattered ponderosa pine trees. Artificial forms are nearly absent from most views.

The overall scenic quality of the Dry Creek study area is high. Most views in this study area are unobstructed and extend to the adjacent hilltop and mesa tops, and are void of any artificial form distractions (KOPs 1, 3, 4, and 5, Figure D-1). The only artificial forms visible from these KOPs are a few single-family homes on the west side of the study area, wire fences, and gravel roads. These high scenic quality views also possess variety in land forms, rock forms, and color and texture.

KOP 2 (Figure D-1) has moderate to high scenic quality. Views of the horizon edges and some land form variations and rock forms are partially obscured by hills and vegetation. Additionally, artificial forms of the gravel road, an abandoned corral with outbuildings, and a deteriorated pond dam dominate the foreground of the views of the alternative reservoir site.

The scenic quality of the Dry Creek Reservoir site within the study area is high. This location is characterized by undisturbed hills, a creek with cottonwoods and willows along both banks, and exposed rock outcrops.

Chimney Hollow Reservoir

Similar to the Dry Creek study area, the Chimney Hollow study area is characterized by a large open valley with foothills land forms, rock outcrops, rocky mesas, scattered evergreen trees, and a single creek in the valley bottom. The hills in the valley are covered with grasses, forbs, low-growing shrubs, and scattered ponderosa pine trees.

However, artificial forms are prevalent in the north and northwest portions of the study area.

The overall scenic quality of the Chimney Hollow study area is moderate to high. Although most views in this study area are unobstructed and extend to the hilltops and mesa tops, multiple large artificial forms exist, such as metal towers on a mountaintop in the northeast, an aboveground white-colored water line running east-west across part of the study area, and overhead utility lines running north-south through the entire study area. The moderate scenic quality views are affected by these artificial forms (KOPs 1, 2, 4, 5, and 6, Figure E-1). However, these views also include distant forested mountain ranges to the northeast. Views with moderate scenic quality are from County Roads 29N and 18E, and the Flatiron Reservoir (KOPs 7, 8, and 9, Figure E-1). Although these views possess a large variety in land form, rock form, and color and texture, they are dominated by the artificial forms of the road (i.e., the water line, water transfer facilities, and overhead utility lines).

The scenic quality of the Chimney Hollow Reservoir site within the study area is high. This location is characterized by undisturbed hills with low-growing shrubs and grasses, scattered ponderosa pine forest, a drainage with cottonwoods and willows, and large exposed rock outcrops on the hogback ridge to the east of the reservoir site.

Ralph Price Reservoir

The scenic quality of the Ralph Price dam and reservoir is high. The existing dam and reservoir are located on City of Longmont property, in mountainous land forms, and are completely surrounded by dense evergreen forest. The existing lake is visible from private roads, two private residences, and trails and shoreline used by recreational users at the lake. KOPs are limited primarily to on-site locations.

VISUAL IMPACTS

Visual Quality at New and Enlarged Reservoirs

The potential impacts to visual quality for each of the five alternative dam and reservoir locations were evaluated (Appendices B through E). In general, there would be an increase in visual quality from observation points above the elevation of the top of the dam that have a view of open water. The scenic quality from observation points below the top of the dam would be reduced at all reservoir sites because of the presence of new artificial forms, such as the top of the dam, the face of the dam, spillway, outlet works, and the reservoir maintenance roads. Scenic quality would not change from some locations because the reservoir/dam would be screened by vegetation, topography, or other existing obstructions.

Locations with the highest scenic quality are characterized mostly by the absence of artificial forms, but also by the presence of rock forms, variety in color and texture, and changes in land forms. Although each dam and reservoir would be located in similar land form types, each has widely varying amounts of visible artificial form and distant mountain range views. Refer to Appendices B through E for rating data.

Jasper East Reservoir

Visual impacts to the Jasper East study area vary with the KOP location relative to the top of the dam elevation and distance from the reservoir. The scenic quality of some of the views from locations below the top of the dam (KOPs 5, 8, 9, 10, and 12, Figure B-1) would be reduced due to the presence of the dam face. Views from U.S. 34, represented by KOPs 1 and 5 (Figure B-1) would be perpendicular to the direction of travel. Therefore, the viewer would have a limited amount of time, while traveling in a vehicle, to see the face of the dam.

The scenic quality of views from locations below the top of the dam (KOPs 2, 3, and 4, Figure B-1) would remain similar to existing conditions because vegetation would partially or completely screen the dam face from these locations. These locations are also relatively far from the dam. At the ANRA entrance (KOP 7, Figure B-1), the existing high scenic quality would remain high due to the presence of an additional water feature. At the residences west of the dam and reservoir represented by KOP 11 (Figure B-1), the scenic quality would increase due to the presence of another water feature. Views from the Willow Creek Reservoir water surface and recreation areas would not be affected because the Jasper East reservoir site would not be visible from most of the area.

KOPs representing the highest scenic quality are located west of the proposed dam and reservoir. This is due to the visibility of distant mountain ranges to the east and southeast, the presence of an existing reservoir, and the absence of artificial forms and containment. The KOPs with the lowest scenic quality would be located southeast of the proposed dam and reservoir due to high levels of containment and the presence of the highway and dam as a dominant artificial form.

Jasper East Reservoir water levels would fluctuate based on planned reservoir operations. The average seasonal changes in water storage would vary from about 20 percent of capacity to about 80 percent (ERO and Boyle 2007). Large fluctuation in volume and elevation would expose a relatively large amount of lakeshore. The area of exposed lakeshore would be void of any plants, including the temporary presence of any annual species; some viewers would consider the exposed lakeshore a negative affect to visual quality. However, the lowest water volume and elevation would occur from early January to mid-May when any visitor use is likely to be low. The highest water volume and elevation would occur during early June to

late September. In average rainfall years, the reservoir would be about three-fourths full.

Rockwell/Mueller Creek Reservoir

Visual impacts to the Rockwell/Mueller Creek Reservoir study area vary. The scenic quality of views from Granby (KOPs 1 through 7, Figure C-1) would remain the same due to the relatively long distance between the KOP and the reservoir, and the large amount of existing artificial forms. The artificial forms in these views, and the trees growing along the Fraser River, would screen the visibility of most of the dam faces. Similarly, views of the dam face from KOPs west of Granby along U.S. 40 (KOPs 7 through 10, Figure C-1) also would be mostly screened by trees growing along the Fraser River. Therefore, the high scenic quality of these KOPs would remain unchanged. At some residential and commercial land use locations east of Granby (KOPs 12 through 14, Figure C-1), the scenic quality would be diminished. These locations would have unobstructed views of one of the dam faces. The scenic quality from residential locations east of Granby (KOPs 16 through 18, Figure C-1) would remain unchanged due to the screening effects of trees and the relatively long distance between the residences and the dam face. The residential location at KOP 15 (Figure C-1) would have the largest reduction in scenic quality due its close proximity and mostly unobstructed view to one of the dam faces.

KOPs representing the highest scenic quality would be located north of the proposed dam and reservoir. This is due to the visibility of distant mountain ranges, the existing wildlife habitat within the reservoir, variety in land forms and vegetation, and the absence of containment. The KOPs with the lowest scenic quality would be located in Granby and southeast of the proposed dam and reservoir. In Granby, this is due to high levels of containment and the presence of artificial forms including railroad facilities, commercial buildings, commercial trash containers, gravel parking areas, and overhead utilities. Many KOP views from Granby have partially or completely obscured views of the dam and reservoir alternative site due to buildings and trees. All KOPs in Granby and southeast of the proposed dam and reservoir would be below the top of the dam elevation.

Rockwell/Mueller Creek Reservoir in Alternative 4 would operate in the same manner as Jasper East Reservoir in Alternative 3; therefore, the effect on reservoir elevations and the visibility of exposed shoreline would be similar. Reservoir fluctuations and exposed shoreline with a 30,000 AF Rockwell/Mueller Creek Reservoir in Alternative 5 would be similar to the 20,000 AF reservoir in Alternative 4.

Dry Creek Reservoir

Visual impacts to the Dry Creek study area vary with the KOP location relative to the dam location and the top of the dam elevation. The scenic quality of views from south of the dam and reservoir (KOPs 1, 2, 3, and 5, Figure D-1) would be reduced due to the presence of the relatively large artificial form of the dam face. At residential and road locations west of the dam and reservoir (KOP 4, Figure D-1), the high scenic quality would be slightly reduced. The scenic quality at KOP 4 would benefit from the presence of a water feature, but would also be reduced by the presence of multiple artificial forms such as the roads, spillway, top of dam and spillway, and other facilities associated with the Dry Creek Reservoir alternative.

KOPs representing the highest scenic quality would be located west and southwest of the proposed dam and reservoir. This is due to the high visibility of large rock outcrops to the east, northeast, and southeast; the variety of land forms; and the absence of artificial forms and containment. The KOPs with the lowest scenic quality would be located south of the proposed dam and reservoir due to higher levels of containment and the presence of some artificial forms (a pond and unused fencing and ranch outbuildings), including the dam face.

The water elevation in Dry Creek Reservoir in Alternative 5 would vary with the season and climatic conditions during normal reservoir operations. During average runoff years, Dry Creek Reservoir would operate at about 75 to 80 percent of capacity. Thus, reservoir fluctuations would be relatively small, but a portion of the reservoir shoreline would remain visible much of the year. Exposed reservoir shoreline would be similar to other area reservoirs; therefore, effects to visual quality from water level fluctuations would be unnoticeable to most viewers.

Chimney Hollow Reservoir

Visual quality would change in the Chimney Hollow study area from dam construction, transmission line relocation, and other facilities. The transmission line relocation and associated tree removal would be visible from all locations above the top of the dam elevation (KOPs 1 through 6, Figure E-1). The dam face would be visible from locations below the top of the dam elevation (KOPs 7 through 9, Figure E-1).

Locations at the south end of the reservoir alternative (KOPs 4 and 5, Figure E-1) would have scenic views of the reservoir, but would also see a portion of the dam. Planned hiking trails in the Larimer County Open Space (KOPs 2 and 3, Figure E-1) would have a potential increase in scenic views of the reservoir, although trees may screen the view along portions of the trail. Private homes and land on the hogback east of the reservoir site were not accessible for this study, but

residents from this location would experience a change in view from a vegetated valley to open water.

KOPs representing the highest scenic quality would be located west of the proposed dam and reservoir. This is due to the high visibility of large rock outcrops to the east, northeast, and southeast; the variety of land forms and vegetation; and the absence of containment. The KOPs with the lowest scenic quality would be located north of the proposed dam and reservoir due to higher levels of containment and the presence of artificial forms such as a large aboveground water pipeline, overhead power transmission line, and water handling facilities, including the dam face.

The water elevation in the Chimney Hollow Reservoir alternative would vary with the season and climatic conditions during normal reservoir operations. On average, the 90,000 AF Chimney Hollow Reservoir under the Proposed Action would remain within about 95 percent of capacity throughout the year (ERO and Boyle 2007). The minor seasonal changes in volume and elevation would not expose a noticeable amount of bare lakeshore; therefore, effects to visual quality from water level fluctuations would be unnoticeable to most viewers.

A 70,000 AF Chimney Hollow Reservoir under Alternatives 3 and 4 would have a relatively stable water surface elevation on average, remaining at about 70 to 80 percent of capacity throughout the year. Thus, a portion of the reservoir shoreline would remain exposed except during very wet years when storage is higher. Therefore, effects to visual quality from water level fluctuations would be unnoticeable to most viewers.

Ralph Price Reservoir

Estimated visual quality in the Ralph Price study area would not change substantially because a reservoir and dam currently exist at this location.

However, some variation in scenic quality would occur because the size and shape of the dam and reservoir would change. KOPs representing the highest scenic quality would potentially be located north, south, and west of the dam and reservoir alternative. This is due to the high visibility of the existing reservoir and surrounding undisturbed forest. The KOPs with the lowest scenic quality would be located east of the proposed dam and reservoir due to higher levels of containment and the presence of the larger artificial form of the dam face.

Ralph Price Reservoir water elevations would fluctuate slightly more than existing conditions from the exchange of Windy Gap water to the reservoir. During the summer months, the reservoir would operate at about 72 to 80 percent of capacity; therefore, portions of the shoreline would be visible. Although the reservoir would be about 77 acres

larger than existing conditions at capacity, the visual quality of the reservoir would be similar to existing conditions for recreation users.

Visual Quality Effects Common to all Alternatives during Construction

Impacts on scenic quality common to all alternatives during construction would be the generation of dust, the presence of construction equipment, potential nighttime construction lighting, and areas of vegetation clearing. Dust would be emitted from earthmoving activities, construction vehicles, and equipment; and from areas within the construction zone that have been disturbed or where excavated material is stockpiled. This "fugitive" dust could temporarily distract from, or partially obscure, existing views.

Construction duration would range from about 30 months for enlarging Ralph Price Reservoir to up to 4 years for Chimney Hollow Reservoir.

Visual Quality Effects Associated with Existing Reservoirs

In addition to visual quality effects for each of the five alternative dam and reservoir locations, potential visual effects would occur from the operation of new reservoirs and changes in water levels at the existing Granby Reservoir, Carter Lake, and Horsetooth Reservoir (Figure A-1). Water levels in Shadow Mountain Reservoir and Grand Lake would not change, but there would be changes in water quality. Changing water surface elevations can result in visibly exposing more shoreline, increasing distances between lake-edge recreation facilities and the water's edge, and decreasing the area of surface water. Summer reservoir water elevations are most important because the majority of visitation occurs from May through August. Changes in water quality could also affect clarity, algal growth, and the aesthetic value of lakes and reservoirs. Potential effects to visual quality at existing reservoirs are discussed below.

Grand Lake and Shadow Mountain Reservoir

None of the WGFP alternatives would result in changes in the water levels of Grand Lake or Shadow Mountain Reservoir; therefore, there would be no change in the amount of exposed shoreline. These reservoirs would continue to operate under the criteria of the C-BT Project with water level fluctuations of less than 1 foot. Predicted small reductions in water clarity and increased algal growth in Grand Lake may contribute to diminished visual quality at times during the year under all of the alternatives (AMEC 2008). The decrease in water clarity of about 0.3 feet (4 inches) would be the same for Alternatives 1 to 4 and there would be no change for Alternative 5. Chlorophyll *a* concentrations, which reflect algal growth, would increase about 2 to 6

percent, with the greatest change under the Proposed Action and the least under Alternative 5.

There would be no change in clarity in Shadow Mountain Reservoir under any of the alternatives. Predicted minor water quality changes in Shadow Mountain Reservoir are unlikely to noticeably affect the visual quality. Aquatic vegetation would continue to be visible, but none of the alternatives would substantially contribute to the growth of rooted plants.

Granby Reservoir

A change in water storage at Granby Reservoir under all alternatives would affect visual quality by reducing water levels, thereby increasing the amount of visible shoreline, and diminishing the amount of visible surface water. Under existing summer conditions (May to August) in average years, about 290 acres of exposed shoreline are visible. Under the No Action alternative, lower summer water levels in Granby Reservoir would increase the amount of visible shoreline by about 108 acres. The Proposed Action would increase the amount of exposed shoreline by about 270 acres more than existing conditions during the summer. Alternatives 3, 4, and 5 would increase visible shoreline by about 155 acres.

During successive drought years, Granby Reservoir water levels would drop up to 23 feet under the Proposed Action and up to 15 feet under Alternatives 3, 4, and 5, which would increase the amount of visible shoreline. Granby Reservoir water levels currently fluctuate as much as 90 feet, but the lower water levels in average and drought years would reduce the visual quality of the reservoir for some viewers compared to existing conditions.

Windy Gap Reservoir

Windy Gap Reservoir would continue to function as a regulating reservoir for pumping water into Granby Reservoir and that function would not change for any of the alternatives. Additional pumping would not necessarily cause lower reservoir levels. If flows are greater than the pumping rate, excess water flows over the spillway and the reservoir remains full. If flows are less than the pumping rate, the pumps are cycled by running them for less than 24 hours to maintain the flows below Windy Gap at the 90 cfs minimum. During the cycling operation, the water level in Windy Gap Reservoir would fluctuate by 1 to 2 feet, but typically would not cause noticeable exposed lake shoreline. Algae are visible in the reservoir under existing conditions and this would continue in the future under all of the alternatives. Increased nutrient loadings from upstream sources could cause an increase in algal growth and, therefore, reduce the visual quality of the reservoir.

Carter Lake

A decrease in water levels of about 1 foot on average in Carter Lake would result in a negligible change to shoreline visibility that would probably not be noticeable under any of the alternatives. Dry year changes in Carter Lake water levels would also be less than 1 foot under all of the alternatives with negligible effects on the visual quality of the reservoir. During wet years, water levels would be as much as 2 feet lower than existing conditions in the summer months, but water levels would remain above average and would have little or no noticeable affect on visual quality.

Horsetooth Reservoir

At Horsetooth Reservoir, under existing conditions in the summer (May to August) of average years, about 82 acres of exposed shoreline are visible. Under the No Action alternative, exposed shoreline would increase less than 6 acres in the summer, which would not noticeably increase shoreline visibility. Under the Proposed Action, the exposed shoreline would increase about 73 acres on average in the summer. For Alternatives 3, 4, and 5, the additional shoreline exposure would average less than 24 acres. In dry years, the additional visible shoreline under the No Action alternative in the summer would be less than 6 acres compared to a maximum of 109 acres for the Proposed Action. Alternatives 3, 4, and 5 would increase the visible shoreline from 6 to 66 acres during the summer months of dry years. The effect to visual quality from water level fluctuations would be unnoticeable to most viewers because of current water level fluctuations and relatively small changes in surface area in a reservoir that is typically about 1,800 acres in size during the summer.

Visual Quality Effects Associated with Changes in Streamflow

West Slope

As discussed in greater detail in the Water Resources Technical Report (ERO and Boyle 2007) and the Recreation Resources Technical Report (ERO 2008), all of the alternatives would result in a change in streamflow on the West Slope from increased diversions on the Colorado River and operational changes that reduce flows on Willow Creek. The majority of these streamflow reductions occur in May and June, but could occur from April to October. Average monthly stream stage below Windy Gap Reservoir would decrease up to 0.1 feet under the No Action alternative, 0.22 feet under the Proposed Action, and about 0.19 feet for the other alternatives. There would be no change in Colorado River flows from existing conditions in dry years and the change in wet years would be greater, but streamflows would be substantially higher than average years. Reductions in Colorado River

average monthly stream stage downstream of Kremmling would range from about 0.12 feet for the No Action alternative to 0.28 feet under the Proposed Action, and about 0.24 feet for the other alternatives. Lower streamflows could potentially reduce the visual quality of the Colorado River, but for most viewers these changes would not be discernible.

Average annual streamflow in Willow Creek below Willow Creek Reservoir would decrease about 7 percent under the No Action alternative compared to about 14 percent for the Proposed Action and 12 percent for the other alternatives. The projected lower flows would occur from May to November and would reduce the visual quality of the stream for some viewers, although public access to this section of the stream is limited.

East Slope

The additional import of water to the East Slope through the Adams Tunnel would result in slightly increased flows to several streams. The Big Thompson River below Estes Park to the canyon mouth would experience an increase in average monthly flow of up to 1 percent under the No Action alternative, 9 percent under the Proposed Action, and less than 5 percent for the other alternatives. Streams below Participant wastewater treatment plants (WWTP) also would have an increase in flows following use of Windy Gap water. Streams that would experience an increase in flows below WWTPs include St. Vrain Creek, Big Thompson Creek, Big Dry Creek, and Coal Creek. The relatively small increases in flows would most likely be unnoticeable to most viewers. Under the No Action alternative, there would be both increases and decreases in streamflow below Ralph Price Reservoir in the North Forth of the St. Vrain River and the St. Vrain River above Lyons from exchanges and releases to storage. Visual quality would potentially decrease in May and July, and increase in other months.

CUMULATIVE EFFECTS

Cumulative effects are those effects resulting from the incremental impact of an alternative when added to other past, present, and reasonably foreseeable future actions. Cumulative effects can result from individually minor, but collectively significant, actions taking place over time.

Several reasonably foreseeable actions are anticipated to occur in the future regardless of the implementation of any of the action alternatives or the No Action alternative. Reasonably foreseeable actions include water-based actions that affect portions of the Colorado River affected by the WGFP, and land-based actions that include ground disturbances near potential WGFP facilities.

Water-Based Reasonably Foreseeable Actions

Reasonably foreseeable water-based actions expected to occur in the future include the Denver Water Moffat Collection System Project, urban growth in Grand and Summit counties, reduction of Excel Energy's Shoshone Power Plant call, changes in releases from Williams Fork and Wolford Mountain Reservoirs to meet U.S. Fish and Wildlife Service flow recommendations for endangered fish in the 15-mile reach, Wolford Mountain Reservoir contract demand, and the expiration of Denver Water's contract with Big Lake Ditch in 2013. Reasonably foreseeable water-based actions on the West Slope would affect streamflows in the Colorado River, but would not result in any new direct disturbance that would affect visual quality. The hydrologic changes to streams and reservoirs associated with implementation of future water and the WGFP were evaluated for potential affects to visual quality.

Visual Quality Effects Associated with Changes in Hydrology

New or Enlarged Reservoirs

Chimney Hollow Reservoir, Dry Creek Reservoir, Jasper East Reservoir, Rockwell/Mueller Creek Reservoir, or an enlarged Ralph Price Reservoir would all operate in a manner similar to no reasonably foreseeable actions; therefore, the visual quality of these reservoirs would be similar to that described previously for direct effects.

Existing Reservoirs

Grand Lake and Shadow Mountain Reservoir. Water levels in these reservoirs would not change from existing conditions; therefore, there would be no change in visible shoreline. Predicted water quality changes potentially affecting the visual quality of Grand Lake include a decrease in clarity of about 0.3 feet for the Proposed Action, no change for the No Action alternative, and an improvement in clarity of about 0.3 feet for the other alternatives (AMEC 2008). Chlorophyll *a* concentrations, as a measure of algae, would increase about 2 percent for the Proposed Action, remain the same for the No Action alternative, and decrease about 6 percent for the other alternatives. The predicted small reductions in water clarity and increased algal growth in Grand Lake may contribute to diminished visual quality at times during the year under all of the alternatives.

Water clarity and chlorophyll *a* concentrations in Shadow Mountain Reservoir would not change under the No Action alternative or the Proposed Action. Under Alternatives 3, 4, and 5, clarity would improve about 0.1 meter and chlorophyll *a* would decrease about 5 percent on average. Thus, there would be no change in the visual

quality of Shadow Mountain Reservoir under the No Action and Proposed Action alternatives and a slight improvement under the other alternatives.

Granby Reservoir. Under existing conditions, in average years during the summer (May to August), about 290 acres of exposed shoreline are visible. Under the No Action alternative, exposed shoreline would increase about 160 acres during the summer. The Proposed Action would increase the average summer shoreline exposure about 350 acres. Alternatives 3 to 5 would increase the amount of exposed shoreline about 166 acres. Changes in shoreline exposure would decrease the visual quality of the reservoir under all alternatives for some viewers.

A relatively narrow exposed shoreline is assumed visible with reservoir water surface area averaging about 6,760 acres in the summer during wet years under existing conditions. Under the No Action alternative, exposed shoreline would increase about 170 acres in the summer and under the Proposed Action, the exposed shoreline would increase about 290 acres. Under Alternatives 3 to 5, the exposed shoreline would increase about 230 acres.

In the summer in dry years under existing conditions, the reservoir water surface area is about 6,020 acres with an exposed shoreline of about 740 acres. Under the No Action alternative, exposed shoreline would increase about 170 acres. Under the Proposed Action, the exposed shoreline would increase about 290 acres. Under Alternatives 3 to 5, the exposed shoreline would increase about 150 acres. Although the increases in exposed shoreline would diminish visual quality for some viewers, during dry year conditions, a relatively large and highly visible exposed shoreline exists at the reservoir. Therefore, changes in area of exposed shoreline during dry years would be minimal.

Windy Gap Reservoir. Cumulative effects to visual quality in Windy Gap Reservoir would be similar to those described for direct effects.

Carter Lake. Water levels changes at Carter Lake would not be noticeably affected under any of the alternatives. During average or dry years, average monthly surface area would decrease less than 5 acres and lake levels would not decrease more than 1 foot under any of the alternatives. In wet years, under all alternatives, the average monthly lake surface area would decrease less than 11 acres and lake levels would decrease less than 2 feet for all alternatives. In dry years, fluctuations would be within 1 foot of existing conditions for all alternatives. Therefore, changes to exposed shoreline areas and the visual quality of the reservoir would be negligible or unnoticeable.

Horsetooth Reservoir. At Horsetooth Reservoir, under existing conditions in the summer (May to August) of average years, about 82 acres of exposed shoreline are visible. The No Action alternative would not affect water levels in Horsetooth Reservoir during

summer(the peak recreation season) under average conditions, wet years, or dry years. The Proposed Action would increase exposed shoreline area less than 72 acres during the same period under average conditions. Alternative 5 would increase exposed shoreline area less than 25 acres during summer average conditions. There would be less than a 2-acre change in exposed shoreline in wet years under the No Action alternative. During wet years, the Proposed Action would increase exposed shoreline area less than 70 acres and Alternatives 3 to 5 would increase exposed shoreline area less than 15 acres. The Proposed Action would increase exposed shoreline area up to 89 acres during dry years, compared to 53 acres for Alternatives 3 to 5 and less than 3 acres for the No Action alternative. Therefore, changes to exposed shoreline areas and the visual quality of the reservoir would be negligible or unnoticeable.

West Slope Streams

Cumulative effects to Colorado River streamflow would occur with reasonably foreseeable future water-based actions implemented along with one of the WGFP alternatives. Average monthly change in stream stage below Windy Gap Reservoir would decrease up to 0.19 foot under the No Action alternative, 0.33 foot under the Proposed Action, and about 0.29 foot for the other alternatives. Dry year changes in stream stage of less than 0.3 feet would occur as the result of reasonably foreseeable actions. The change in stream stage in wet years would be greater, but streamflows would be substantially higher than average years. Reductions in Colorado River average monthly stream stage downstream of Kremmling would range from about 0.85 feet for the No Action alternative to 1.04 feet under the Proposed Action, and about 1.00 foot for the other alternatives. The stream channel at this gage near the mouth of Gore Canyon is much narrower and deeper than upstream portions of the Colorado River. Lower streamflows could potentially reduce the scenic quality of the Colorado River, but for many viewers these changes may not be discernible.

Average annual streamflow in Willow Creek below Willow Creek Reservoir would decrease about 9 percent under the No Action alternative compared to about 15 percent for the Proposed Action and 13 percent for the other alternatives. The projected lower flows would occur from May to November and may reduce the visual quality of the stream, but there is limited public access to this section of the stream.

East Slope

The additional import of water to the East Slope through the Adams Tunnel would result in a slight increase in flows to several streams, with cumulative effects similar to those described for direct effects. The relatively small increases in flows are unlikely to be discernable

and, therefore, would not change the visual quality of these streams from existing conditions.

Land-Based Reasonably Foreseeable Actions

The following are land-based reasonably foreseeable actions relevant to the WGFP (Figure 1 and Figure 2).

Land Development. A variety of new land developments are expected to occur in the vicinity of the potential WGFP reservoir sites in Larimer and Grand counties. Land use changes or developments within about 5 miles of the Jasper East and Rockwell/Mueller Creek Reservoir sites were identified to provide a context for assessing potential local cumulative effects of multiple land disturbances for other resources. However, for the visibility analyses, a 2.5-mile radius around the potential reservoir sites was used.

Near Jasper East, this 2.5-mile radius encompasses a planned residential development at C-Lazy-U Preserves located north of the reservoir site (Hale, pers. comm. 2005; Campbell, pers. comm. 2006) (Figure 1). Near the Rockwell/Mueller Creek Reservoir site, residential, commercial, and mixed development in the Granby Ranch area have been and will continue to be developed.

On the East Slope, several land developments are planned near potential reservoir sites. As of June 2007, several small land developments near the Chimney Hollow and Dry Creek Reservoir sites were under county development review for subdivision, dispersed residential development, commercial development, and/or special review for a proposed change in land use (Larimer County 2007) (Figure 2).

Larimer County Open Space. Larimer County Parks and Open Lands acquired about 1,850 acres of land adjacent to the proposed Chimney Hollow Reservoir site. Larimer County intends to manage this property for recreation use in the future regardless of whether Chimney Hollow Reservoir is constructed.

Urban Growth in the Northern Front Range. Continued population growth and urban development is expected to occur in the northern Front Range Colorado communities served by many of the Participants regardless of the proposed WGFP.

Ralph Price Reservoir

No reasonably foreseeable actions were identified near Ralph Price Reservoir that would add to the cumulative visual effects for the area.

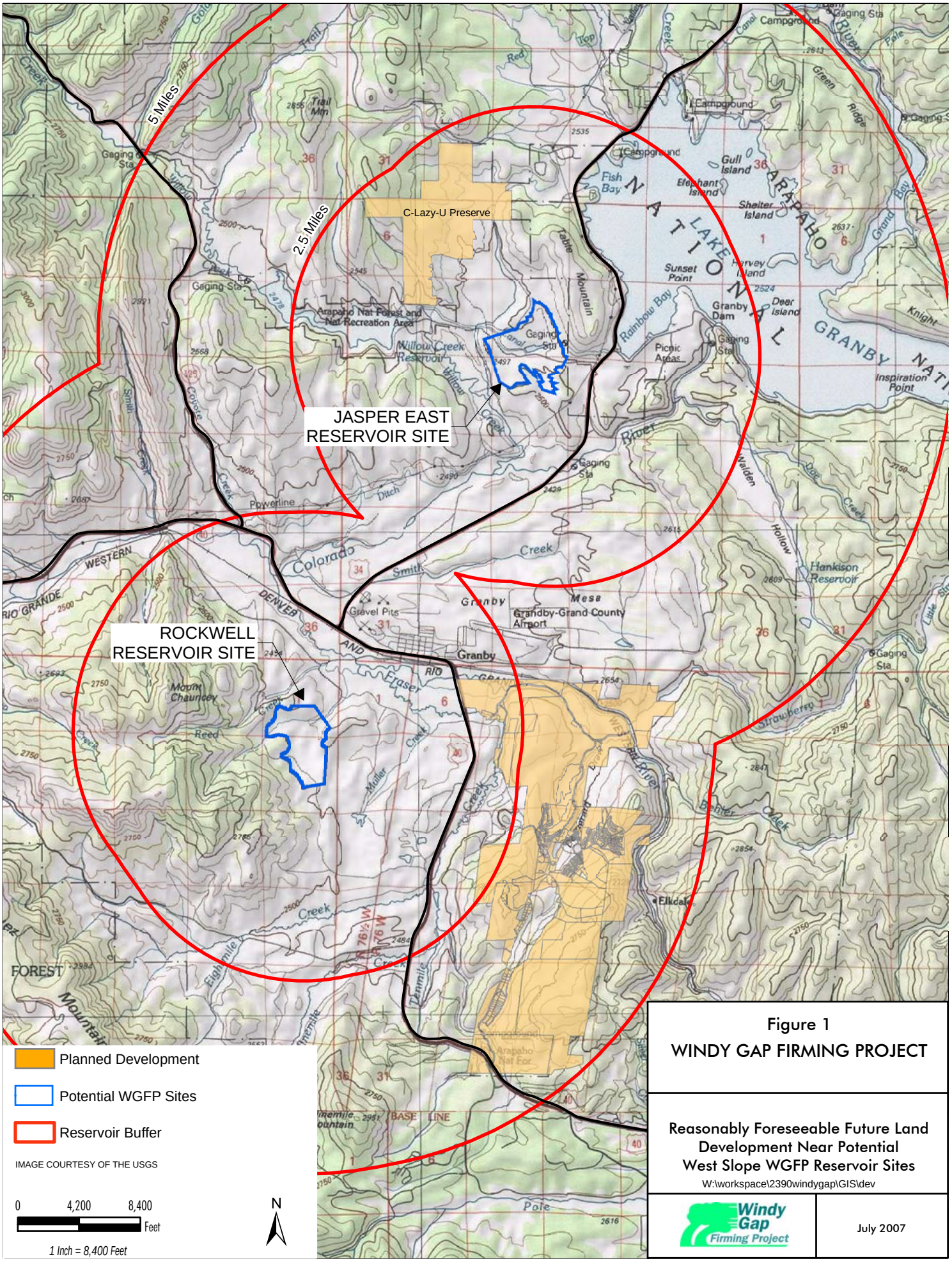


Figure 1

WINDY GAP FIRMING PROJECT

Reasonably Foreseeable Future Land Development Near Potential West Slope WGFP Reservoir Sites

W:\workspace\2390windygap\GIS\dev

Windy Gap Firming Project

July 2007

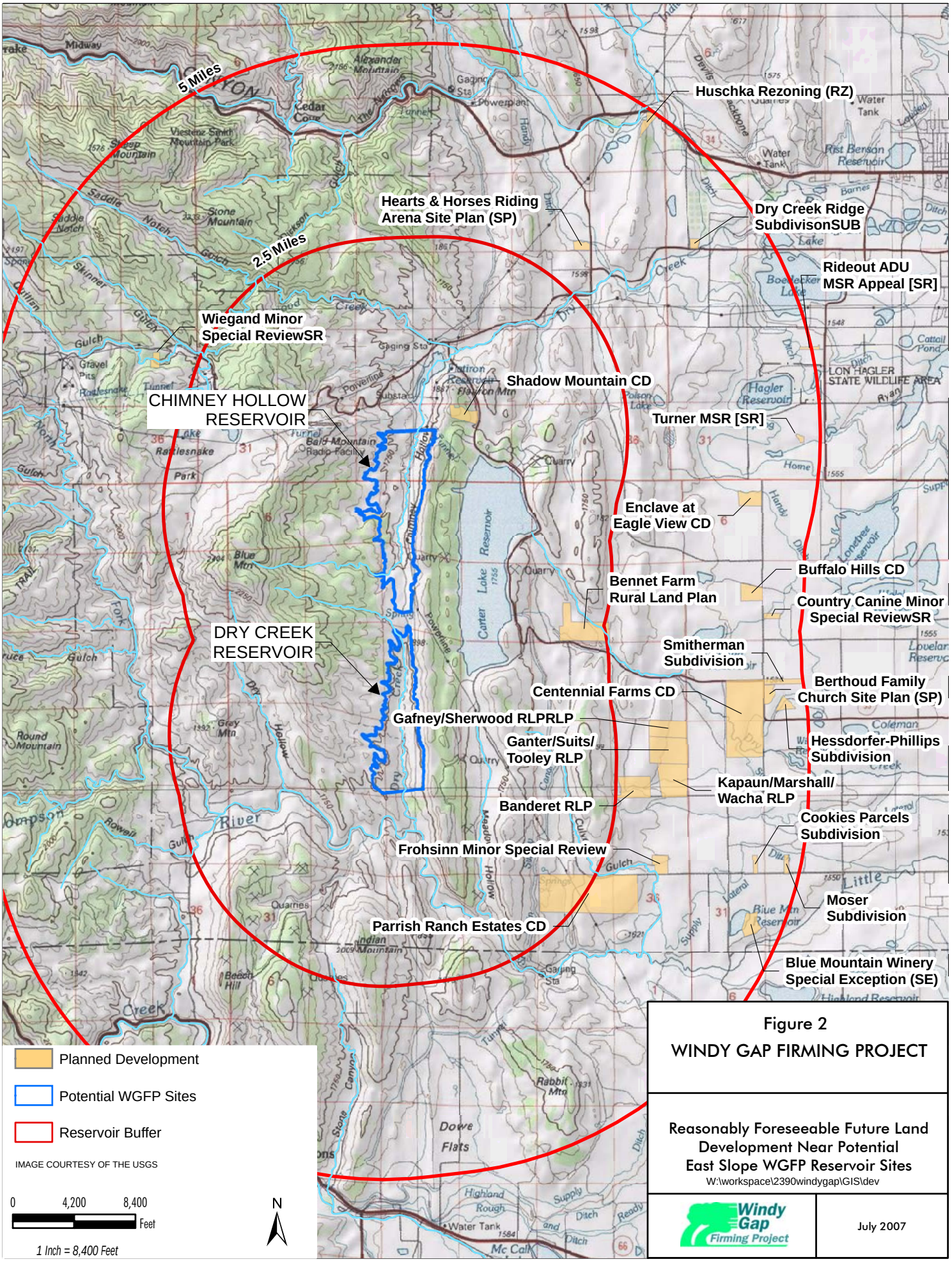


Figure 2

WINDY GAP FIRMING PROJECT

Reasonably Foreseeable Future Land Development Near Potential East Slope WGFP Reservoir Sites

W:\workspace\2390windygap\GIS\dev

Windy Gap Firming Project

July 2007

Chimney Hollow Reservoir

The only reasonably foreseeable land developments within 2.5 miles of Chimney Hollow Reservoir are residential developments northeast and east of Carter Lake, and planned future trail development on Larimer County Open Space on the west side of Chimney Hollow. The planned residential development near Carter Lake would add an artificial form to the landscape. Trails on Larimer County Open Space would add linear features to the landscape, but many of the trails would be screened by forest vegetation.

Dry Creek Reservoir

Several small residential developments within 2.5 miles of the Dry Creek Reservoir site would add to cumulative visual impacts in the region.

Jasper East Reservoir

The planned C-Lazy-U Preservers is located about 1 mile northwest of the Jasper East Reservoir site. The low-density housing planned for C-Lazy-U Preservers and residential development on other properties in the study area would contribute to a cumulative change in the visual quality of the area. Western Area Power Administration (Western) plans to rebuild the transmission line between the Granby Pumping Plant on the north side of Granby Reservoir and the Windy Gap Substation near Windy Gap Reservoir. The use of new poles in the existing alignment or a possible new alignment would result in an additional change the landscape east of the Jasper Reservoir site.

Rockwell/Mueller Creek Reservoir

Planned future residential and commercial developments within 2.5 miles of the Rockwell/Mueller Creek Reservoir site, in addition to the reservoir, would result in a cumulative change to the visual quality of the landscape.

REFERENCES

AMEC (AMEC Earth & Environmental, formerly Hydrosphere Resource Consultants). 2008. Windy Gap Firming Project Lake and Reservoir Water Quality Technical Report. Prepared for U.S. Bureau of Reclamation.

Boyle Engineering. 2005. Windy Gap EIS Alternatives Descriptions Report. Prepared from the Municipal Subdistrict, Northern Colorado Water Conservancy District.

Campbell, D. 2006. Director, Department of Planning and Zoning, Grand County, Colorado. Email communication

between Debra Campbell and Andy Cole, Natural Resource Planner, ERO Resources Corporation. December 9.

ERO (ERO Resources Corporation). 2005a. Windy Gap Firming Project: Purpose and Need Report. Prepared for Bureau of Reclamation, Eastern Colorado Area Office.

ERO (ERO Resources Corporation). 2005b. Windy Gap Firming Project: Alternatives Report. Prepared for Bureau of Reclamation, Eastern Colorado Area Office.

ERO (ERO Resources Corporation). 2008. Windy Gap Firming Project Recreation Resources Technical Report. Prepared for the U.S. Bureau of Reclamation.

ERO and Boyle (ERO Resources Corporation and Boyle Engineering). 2007. Windy Gap Firming Project Water Resources Technical Report. Prepared for Bureau of Reclamation, Eastern Colorado Area Office.

FHWA (Federal Highway Administration). 1994. Visual Prioritization Process User's Manual (VPP).

Hale, T. 2005. Town of Granby. Personal communication with Scott Babcock, ERO Resources Corporation. May 10.

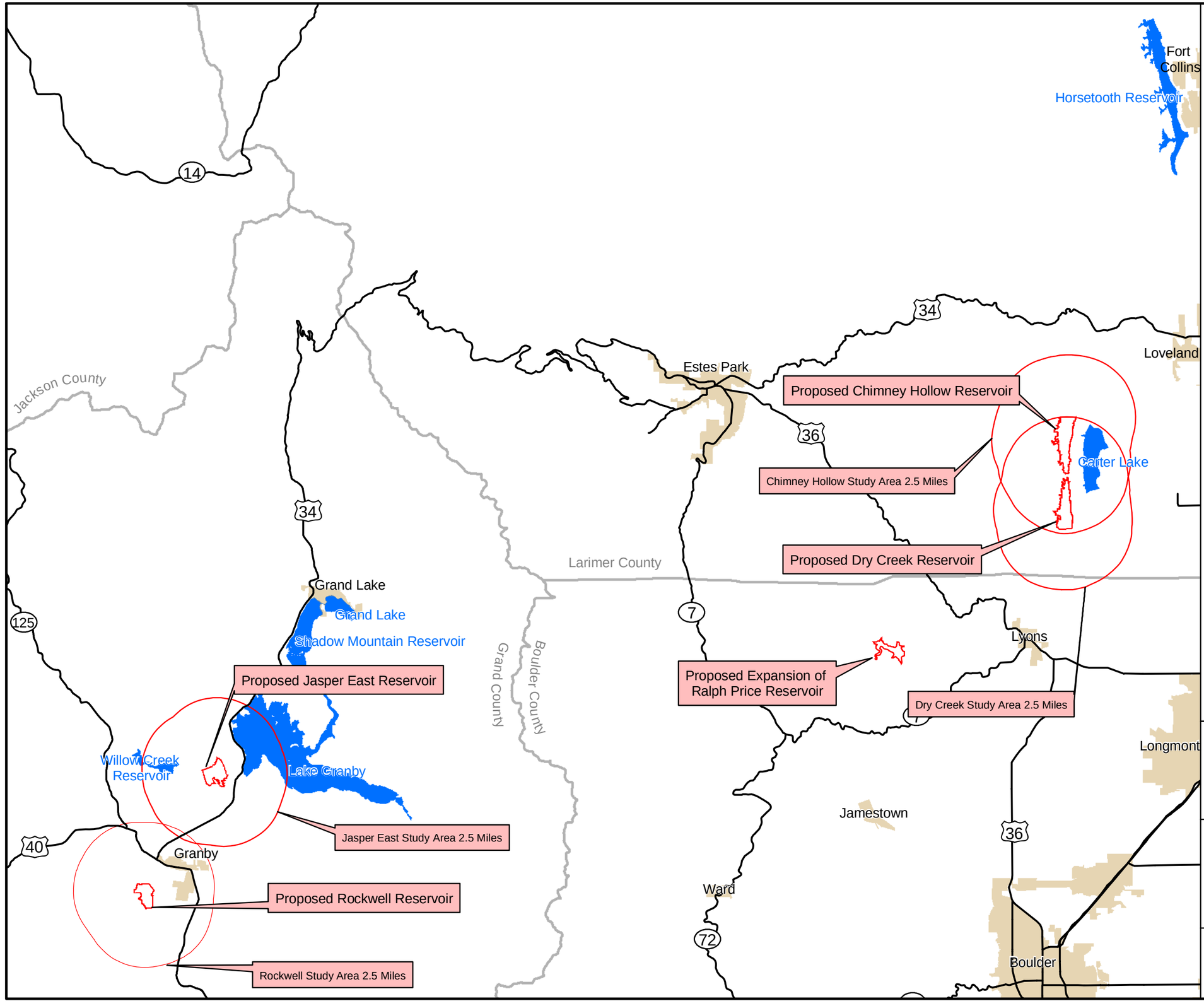
I Cubed. 2003. Rectified 1-meter color photography for the Chimney Hollow and Dry Creek sites. Fort Collins, CO.

Larimer County. 2007. Development Activity Map. Prepared by the Larimer County GIS Section. April.

NAD (North American Datum). 1983. NAD 1983 HARN / HPGN Conversion for Volusia County GIS Data. Available at: http://www.volusia.org/gis/nad83conversion.htm.

TerraServer. 2005. USGS 7.5 minute quadrangle digital elevation terrain (DTM) data and NHAP rectified, black and white, satellite imagery. Dates based on various USGS orthophoto composites using NHAP imagery from 1990 to 1999. Available at http://www.terraserver.com. Updated 2007.

APPENDIX A: LOCATION MAP



Note: Visual impacts of the proposed Ralph Price dam and reservoir expansion were determined from photographic and descriptive information provided by others.

N

0 2 4 Miles

1 Inch = 4 Miles

ERO Resources Corp.
1842 Clarkson Street
Denver, CO 80218
(303) 830-1188
Fax: 830-1199

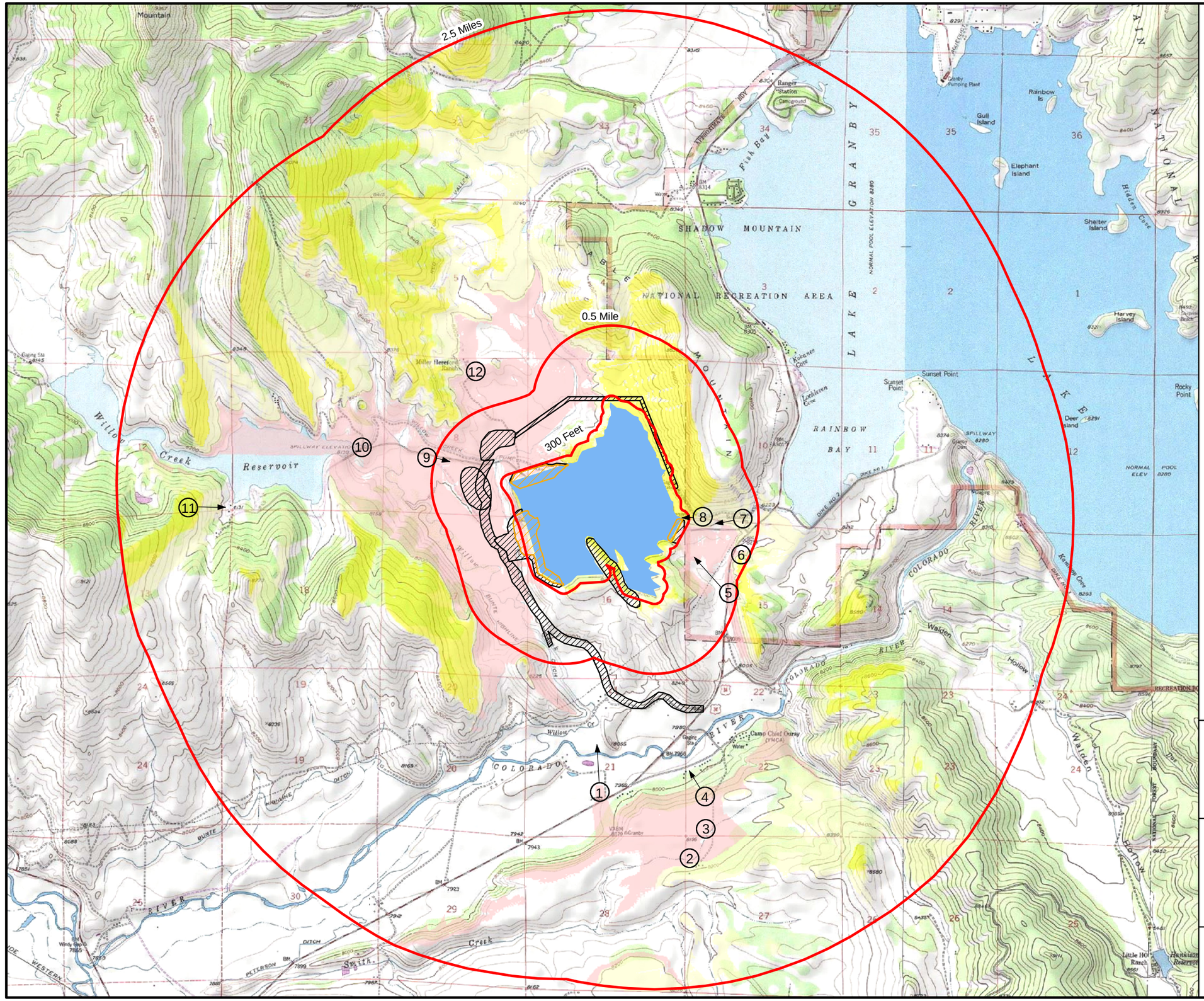
HLA Holdeman Landscape Architecture

Figure A-1
Project Locations and Study Areas

Windy Gap Firming Project

February 2006

APPENDIX B: JASPER EAST RESERVOIR MAP, PHOTOS, AND TABLES



Legend:

- Proposed Jasper East Reservoir
- Proposed Disturbed Area
- Proposed Jasper East Dams (3)
- (12) Key Observation Point (KOP)
- (10) KOP with Direction of Photograph
- Distance Zones from Proposed Reservoir
- Areas where the dam and reservoir are not visible
- Areas where 50% or less of the dam and reservoir are visible
- Areas where 50% or more of the dam and reservoir are visible
- Areas where only the dam is visible

N

0 1,600 3,200 Feet

ERO
ERO Resources Corp.
1842 Clarkson Street
Denver, CO 80218
(303) 830-1188
Fax: (303) 830-1199

HLA
Holdeman Landscape Architecture

Figure B-1
Jasper East Reservoir Visibility Study

Windy Gap Firming Project

February 2006

Exhibit B-2. Visibility Study Photographs

Observation Point 1

Observation Point 4

Observation Point 5

Observation Point 7

Exhibit B-2. Visibility Study Photographs (continued)

Observation Point 8

Observation Point 9

Observation Point 11

Table B-3. Jasper East Existing Scenic Quality Field Data

Location	Land Form	Rock Form	Water Form	Artificial Form	Containment	Color and Texture	Total
1 Highway 34	2	1	0	1	3	2	9
2 Road/Residences	2	1	0	1	2	2	8
3 Road	2	1	0	3	3	2	11
4 Road	2	1	0	3	1	1	8
5 Highway 34	2	1	0	2	2	2	9
6 Highway 34	2	1	0	2	2	2	9
7 NRA Entrance	2	0	0	2	2	2	8
8 NRA Road	2	0	0	2	2	2	8
9 NRA Road	3	2	0	2	3	3	13
10 NRA Dam	3	2	2	2	3	3	15
11 Road/Residences	3	2	2	3	3	3	16
12 Road	2	2	0	2	3	2	11

Table B-4. Jasper East Estimated Scenic Quality with Reservoir

Location	Land Form	Rock Form	Water Form	Artificial Form	Containment	Color and Texture	Total
1 Highway 34	2	1	0	1	3	2	9
2 Road/Residences	2	1	0	1	2	2	8
3 Road	2	1	0	2	3	2	10
4 Road	2	1	0	1	1	1	6
5 Highway 34	2	1	0	2	2	2	9
6 Highway 34	2	1	0	2	2	2	9
7 NRA Entrance	2	0	0	2	2	2	8
8 NRA Road	2	0	0	2	2	2	8
9 NRA Road	3	2	0	1	3	3	12
10 NRA Dam	3	2	2	1	3	3	14
11 Road/Residences	3	2	2	3	3	3	16
12 Road	2	2	0	1	3	2	10

Table B-5. Jasper East Scenic Quality Histogram

Bin	Frequency	Cumulative %
2	0	.00%
4	0	.00%
6	0	.00%
8	4	33.33%
10	3	58.33%
12	2	75.00%
More	3	100.00%

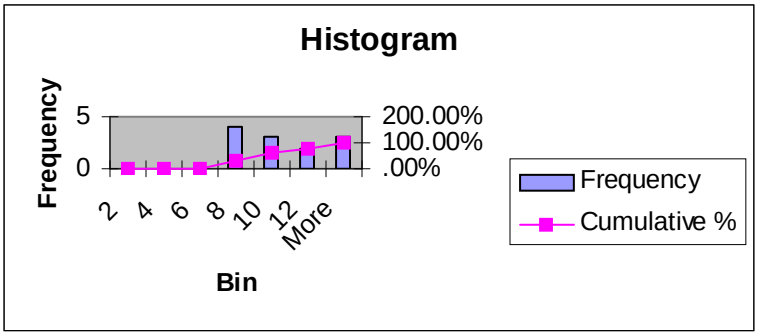
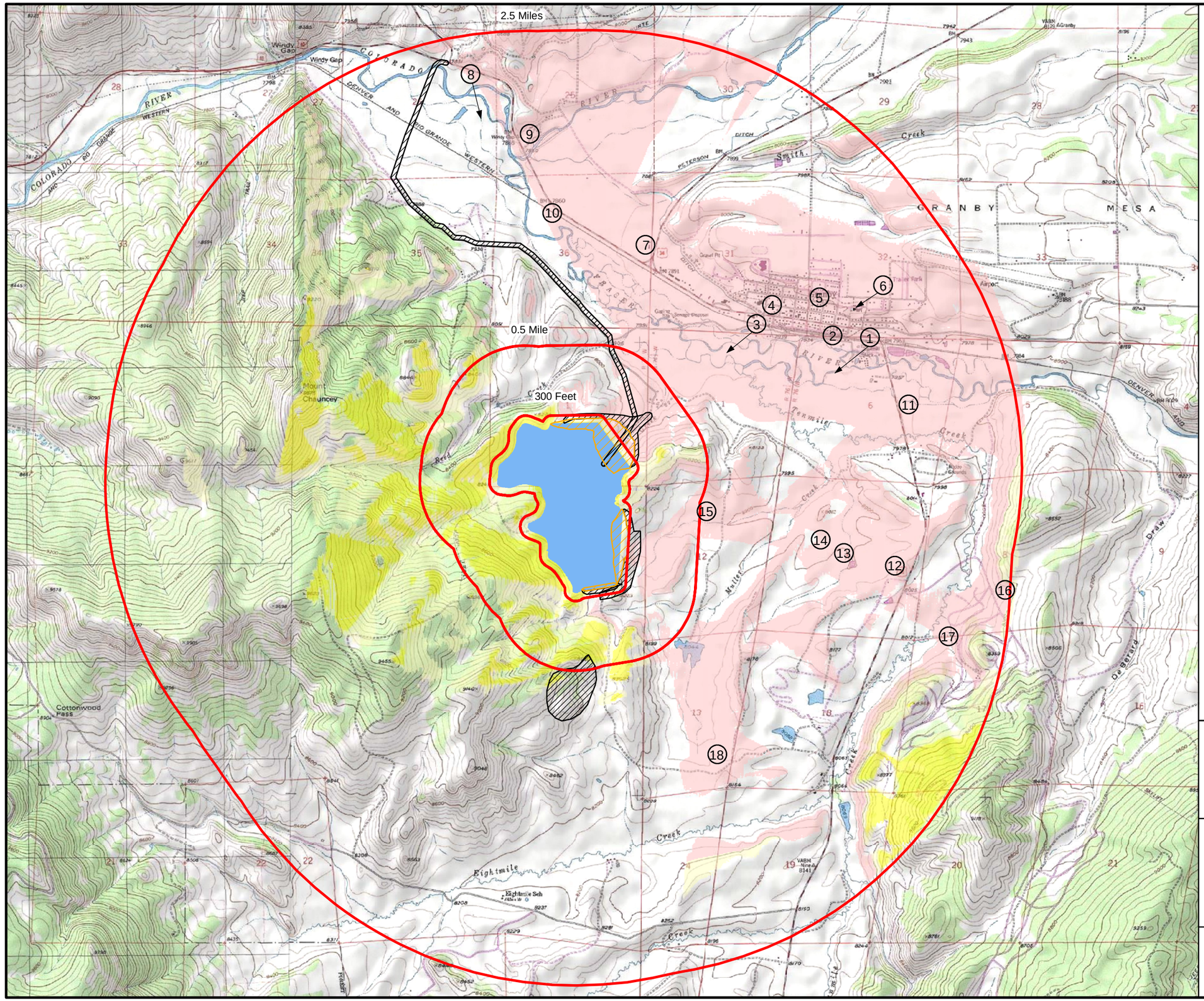


Table B-6. Jasper East Existing Visibility

Location	Distance	View Angle	View Amount	Total
1 Highway 34	2	0	0	2
2 Road/Residences	2	0	0	2
3 Road	2	0	0	2
4 Road	2	0	0	2
5 Highway 34	1	0	0	1
6 Highway 34	1	1	1	3
7 NRA Entrance	1	1	1	3
8 NRA Road	1	1	2	4
9 NRA Road	1	0	0	1
10 NRA Dam	2	0	0	2
11 Road/Residences	2	1	2	5
12 Road	2	0	0	2

Appendix C: Rockwell/Mueller Creek Reservoir Map, Photos, and Tables



Legend:

- Proposed Rockwell Reservoir
- Proposed Disturbed Area
- Proposed Rockwell Dams (2)
- (12) Key Observation Point (KOP)
- (10) KOP with Direction of Photograph
- Distance Zones from Proposed Reservoir
- Areas where the dam and reservoir are not visible
- Areas where 50% or less of the dam and reservoir are visible
- Areas where 50% or more of the dam and reservoir are visible
- Areas where only the dam is visible

N

0 1,600 3,200 Feet

ERO
ERO Resources Corp.
1842 Clarkson Street
Denver, CO 80218
(303) 830-1188
Fax: (303) 830-1199

HLA
Holdeman Landscape Architecture

Figure C-1
Rockwell/Mueller Reservoir Visibility Study (30,000 AF)

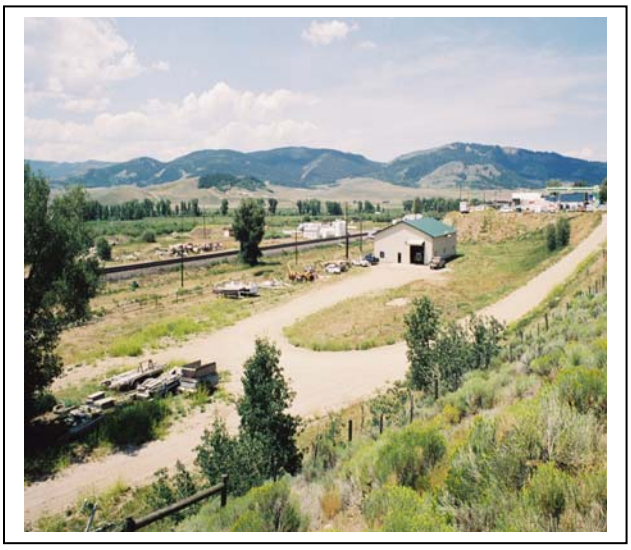
Windy Gap Firming Project

February 2006

Exhibit C-2. Visibility Study Photographs

Observation Point 1

Observation Point 3



Observation Point 6

Observation Point 8

Table C-3. Rockwell/Mueller Creek Existing Scenic Quality Field Data

Location	Land Form	Rock Form	Water Form	Artificial Form	Containment	Color and Texture	Total
1 Road/Commercial	1	1	0	1	3	2	8
2 Road/Commercial	2	2	0	1	3	2	10
3 Road/Commercial	1	1	0	1	2	2	7
4 Road/Commercial	2	1	0	1	3	2	9
5 Road/Residential	2	1	0	1	3	2	9
6 Road/Residential	2	2	0	0	2	1	7
7 Road/Commercial	2	1	0	2	3	2	10
8 Interpretive Site	3	2	2	2	3	3	15
9 Highway	2	1	0	2	2	2	9
10 Highway	2	1	0	2	3	2	10
11 Highway	1	1	0	2	2	2	8
12 Road/Commercial	2	1	0	2	3	2	10
13 Road/Residential	2	2	0	2	3	3	12
14 Golf Course	2	2	0	2	3	3	12
15 Road/Residential	2	2	0	2	3	3	12
16 Road/Residential	2	2	0	1	2	3	10
17 Road/Residential	2	2	0	2	2	3	11
18 Road/Residential	2	2	0	2	3	3	12

Table C-4. Rockwell/Mueller Creek Estimated Scenic Quality with Reservoir

Location	Land Form	Rock Form	Water Form	Artificial Form	Containment	Color and Texture	Total
1 Road/Commercial	1	1	0	1	3	2	8
2 Road/Commercial	2	2	0	1	3	2	10
3 Road/Commercial	1	1	0	1	2	2	7
4 Road/Commercial	2	1	0	1	3	2	9
5 Road/Residential	2	1	0	1	3	2	9
6 Road/Residential	2	2	0	0	2	1	7
7 Road/Commercial	2	1	0	1	3	2	9
8 Interpretive Site	3	2	2	1	3	3	14
9 Highway	2	1	0	1	2	2	8
10 Highway	2	1	0	1	3	2	9
11 Highway	1	1	0	1	2	2	7
12 Road/Commercial	2	1	0	1	3	2	9
13 Road/Residential	2	2	0	1	3	3	11
14 Golf Course	2	2	0	1	3	3	11
15 Road/Residential	2	2	0	1	3	3	11
16 Road/Residential	2	2	0	1	2	3	10
17 Road/Residential	2	2	0	1	2	3	10
18 Road/Residential	2	2	0	1	3	3	11

Table C-5. Rockwell/Mueller Creek Scenic Quality Histogram

Bin	Frequency	Cumulative %
2	0	.00%
4	0	.00%
6	0	.00%
8	4	22.22%
10	8	66.67%
12	5	94.44%
More	1	100.00%

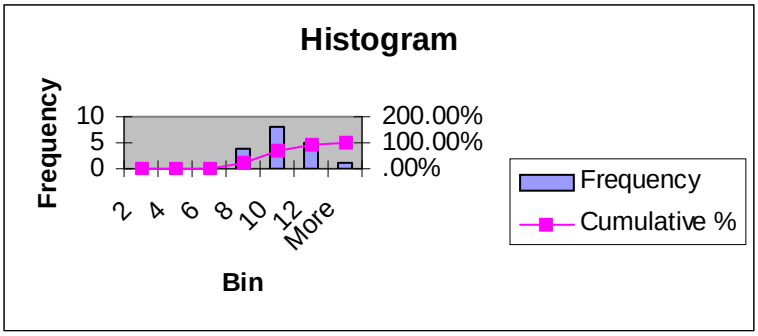
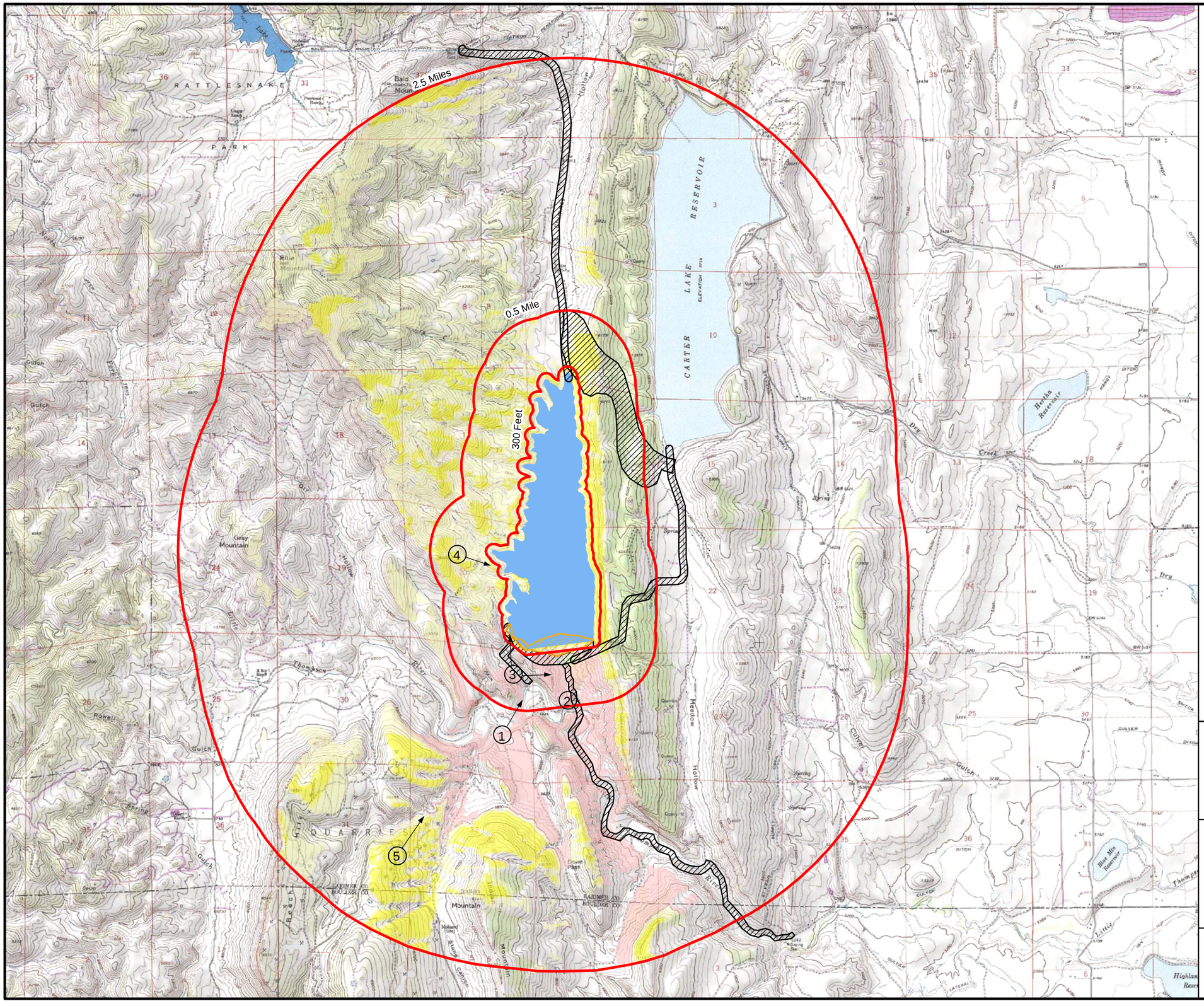


Table C-6. Rockwell/Mueller Creek Existing Visibility

Location	Distance	View Angle	View Amount	Total
1 Road/Commercial	2	0	0	2
2 Road/Commercial	2	0	0	2
3 Road/Commercial	2	0	0	2
4 Road/Commercial	2	0	0	2
5 Road/Residential	2	0	0	2
6 Road/Residential	2	0	0	2
7 Road/Commercial	2	0	0	2
8 Interpretive Site	2	0	0	2
9 Highway	2	0	0	2
10 Highway	2	0	0	2
11 Highway	2	0	0	2
12 Road/Commercial	2	0	0	2
13 Road/Residential	2	0	0	2
14 Golf Course	2	0	0	2
15 Road/Residential	2	0	0	2
16 Road/Residential	2	0	1	3
17 Road/Residential	2	0	0	2
18 Road/Residential	2	0	0	2

APPENDIX D: DRY CREEK RESERVOIR MAP, PHOTOS, AND TABLES



Legend:

- Proposed Dry Creek Reservoir
- Proposed Disturbed Area
- Proposed Dry Creek Dam
- (12) Key Observation Point (KOP)
- (10) KOP with Direction of Photograph
- Distance Zones from Proposed Reservoir
- Areas where the dam and reservoir are not visible
- Areas where 50% or less of the dam and reservoir are visible
- Areas where 50% or more of the dam and reservoir are visible
- Areas where only the dam is visible

N

0 2,000 4,000 Feet

ERO
ERO Resources Corp.
1842 Clarkson Street
Denver, CO 80218
(303) 830-1188
Fax: (303) 830-1199

HLA
Holdeman Landscape Architecture

Figure D-1
Dry Creek Reservoir Visibility Study

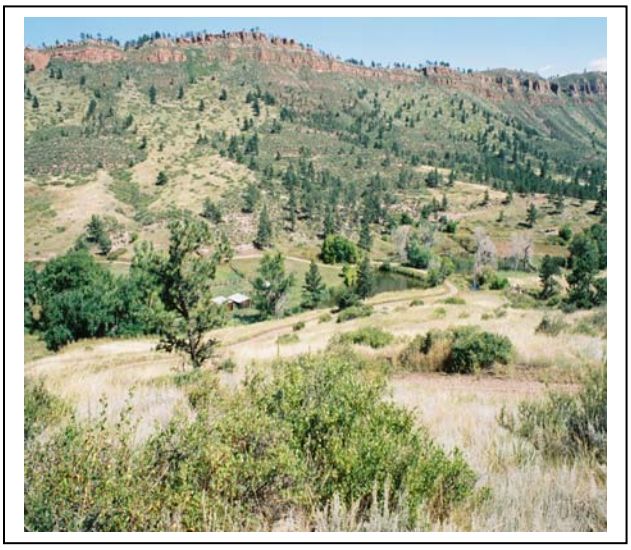
Windy Gap Firming Project

February 2006

Exhibit D-2. Visibility Study Photographs

Observation Point 1

Observation Point 3



Observation Point 4

Observation Point 5

Table D-3. Dry Creek Existing Scenic Quality Field Data

Location	Land Form	Rock Form	Water Form	Artificial Form	Containment	Color and Texture	Total
1 Road	2	1	0	2	3	2	10
2 Road	2	2	1	2	3	2	12
3 Road	2	2	1	2	3	2	12
4 Road/Residences	2	2	0	1	3	2	10
5 Road/Residences	2	1	0	1	3	2	9

Table D-4. Dry Creek Estimated Scenic Quality with Reservoir

Location	Land Form	Rock Form	Water Form	Artificial Form	Containment	Color and Texture	Total
1 Road	2	1	0	0	3	2	8
2 Road	2	2	0	0	3	2	9
3 Road	2	2	0	0	3	2	9
4 Road/Residences	2	2	1	2	3	2	12
5 Road/Residences	2	1	1	1	3	2	10

Table D-5. Dry Creek Scenic Quality Histogram

Bin	Frequency	Cumulative %
4	0	.00%
6	0	.00%
8	1	20.00%
10	3	80.00%
12	1	100.00%
More	0	100.00%

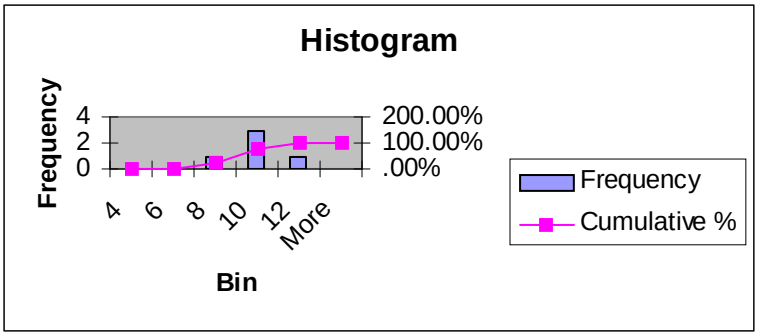
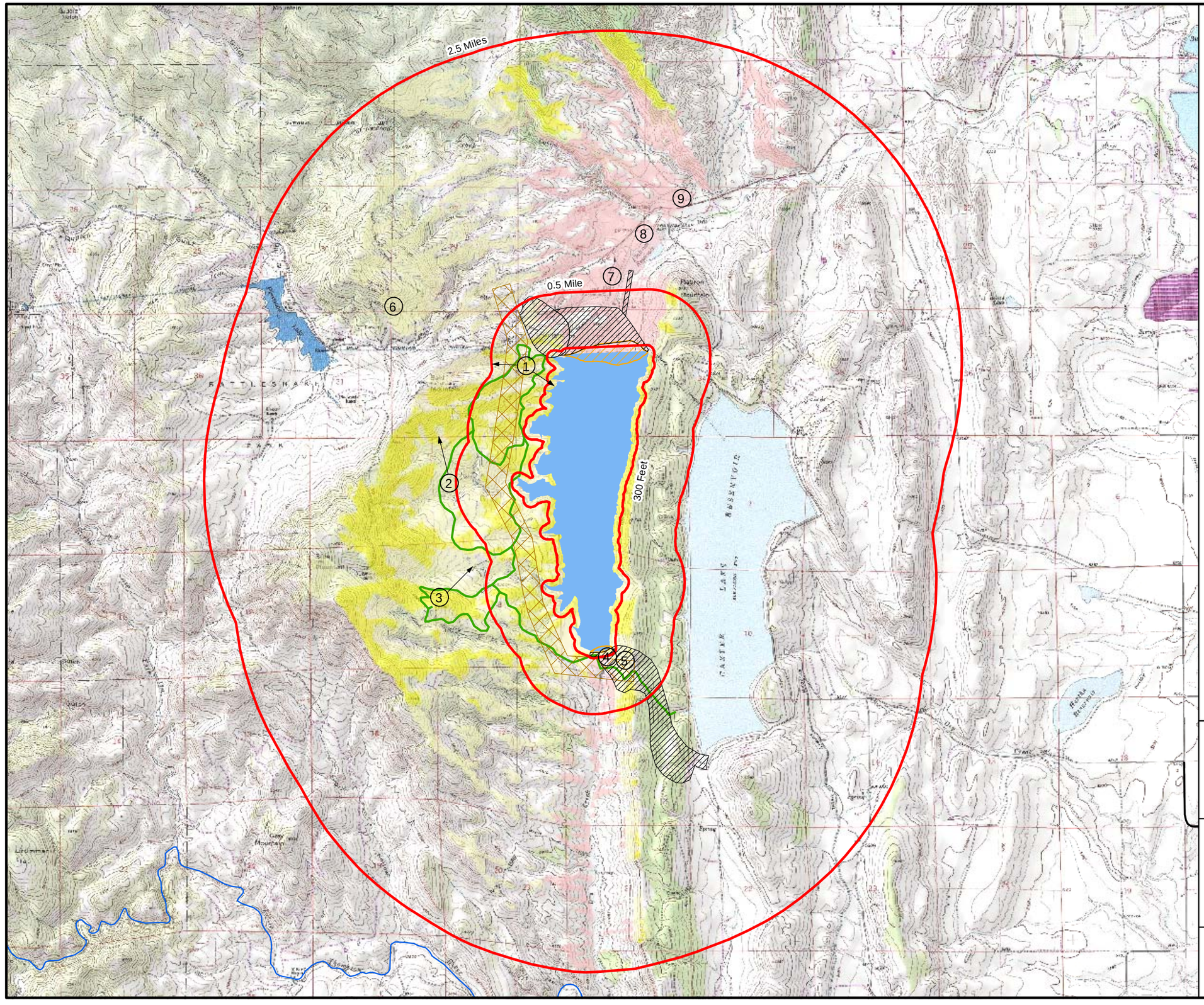


Table D-6. Dry Creek Existing Visibility

Location	Distance	View Angle	View Amount	Total
1 Road	2	0	0	2
2 Road	1	0	0	1
3 Road	1	0	0	1
4 Road/Residences	1	1	2	4
5 Road/Residences	2	1	2	5

Appendix E: Chimney Hollow Reservoir Map, Photos, and Tables



ERO
ERO Resources Corp.
1842 Clarkson Street
Denver, CO 80218
(303) 830-1188
Fax: (303) 830-1199

HLA
Holdeman Landscape Architecture

Figure E-1
Chimney Hollow Reservoir Visibility Study

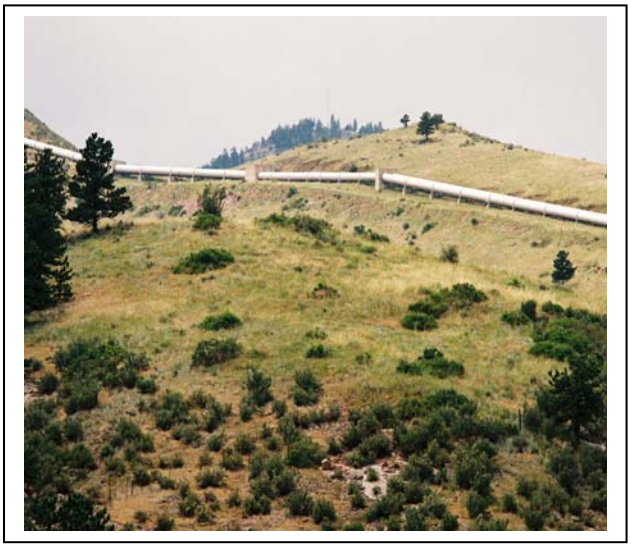
Windy Gap Firming Project

February 2006

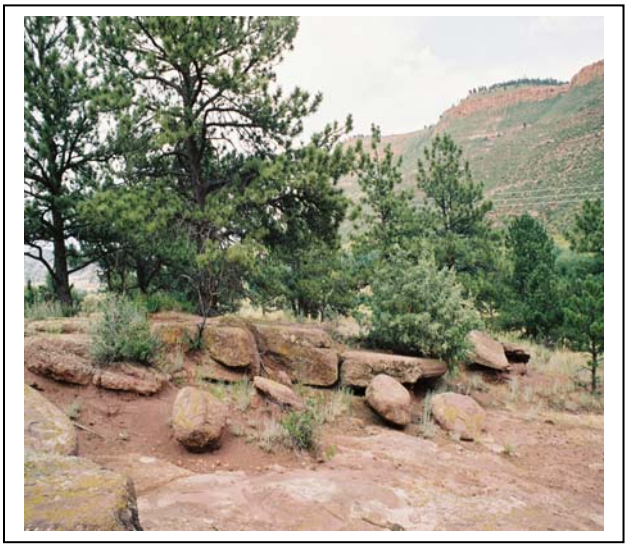
Exhibit E-2. Visibility Study Photographs

Observation Point 1 (looking west)

Observation Point 1 (looking east)



Observation Point 2



Observation Point 3

Table E-3. Chimney Hollow Existing Scenic Quality Field Data

Location	Land Form	Rock Form	Water Form	Artificial Form	Containment	Color and Texture	Total
1 Proposed Trail	2	3	0	2	2	2	11
2 Proposed Trail	2	3	0	2	2	2	11
3 Proposed Trail	2	3	0	2	1	2	10
4 Proposed Trail	2	3	0	2	1	2	10
5 Proposed Trail	2	3	0	2	1	2	10
6 Highway	2	2	1	1	2	2	10
7 Highway	2	3	0	2	2	2	11
8 Highway	2	2	0	1	1	1	7
9 Highway	2	2	0	1	1	2	8

Table E-4. Chimney Hollow Estimated Scenic Quality with Reservoir

Location	Land Form	Rock Form	Water Form	Artificial Form	Containment	Color and Texture	Total
1 Proposed Trail	2	3	1	2	2	2	12
2 Proposed Trail	2	3	1	2	1	2	11
3 Proposed Trail	2	3	1	2	1	2	11
4 Proposed Trail	2	3	1	2	3	2	13
5 Proposed Trail	2	3	1	2	3	2	13
6 Highway	2	2	1	0	2	2	9
7 Highway	2	3	1	1	2	2	11
8 Highway	2	2	0	0	1	1	6
9 Highway	2	2	0	0	1	2	7

Table E-5. Chimney Hollow Scenic Quality Histogram

Bin	Frequency	Cumulative %
4	2	6.45%
6	6	25.81%
8	8	51.61%
10	9	80.65%
12	1	83.87%
More	5	100.00%

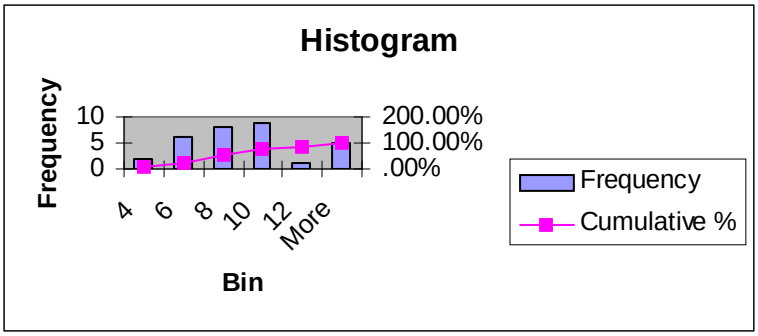


Table E-6. Chimney Hollow Existing Visibility

Location	Distance	View Angle	View Amount	Total
1 Proposed Trail	1	1	2	4
2 Proposed Trail	2	1	1	4
3 Proposed Trail	2	1	1	4
4 Proposed Trail	0	1	2	3
5 Proposed Trail	1	1	2	4
6 Highway	2	0	2	4
7 Highway	2	0	0	2
8 Highway	2	0	0	2
9 Highway	2	0	0	2