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Appendix M
Recreation Facilities Modification Plan

Chatfield Reservoir Recreation Facilities Modification Plan

Prepared for

Colorado Water Conservation Board
in association with
Colorado State Parks

Prepared by

EDAW | AECOM

January 2010

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Chapter 1. Introduction

This report documents the results of a study conducted to identify opportunities and costs for the modification plan of impacts to recreation facilities and uses at Chatfield State Park that would result from an increase in the average high water level in Chatfield Reservoir. The need for this plan arises from a project called the Chatfield Reservoir Storage Reallocation Project (Reallocation Project). The Reallocation Project focuses on the feasibility of increasing the storage capacity of Chatfield Reservoir by raising the average high water level in the reservoir and reallocating a portion of flood control storage to other uses, including water supply for surrounding communities. As described in more detail later in this report, the recreation facilities modification plan is based on an increase in the average high water level by approximately 12-ft.

In addition, hydrologic model results indicate that the reservoir would experience a higher degree of fluctuation than has been historically the case or that had been indicated by earlier model results. For this reason, the initial Chatfield Reallocation Study, which was completed in 2004, was updated to reflect the new operating regime. See Appendix 5 to reference the original report.

An additional consideration that led to the revision of the 2004 report was a determination by the U.S. Army Corps of Engineers (USACE) that the 10-year flood pool elevation was 5454', an elevation several feet higher than the 5447' elevation used in the 2004 report. Per applicable USACE guidance, no structures such as restrooms or other closed buildings can be located within the 10-year flood pool. This determination required a reconsideration of additional design alternatives, including an increased amount of fill to elevate structures above the 10-year flood pool. Ultimately, as documented in Appendix 6, USACE approved an exception to their policies, thus allowing functionally-dependent structures to be located within the 10-year flood pool at an elevation of 5447'. While the approved USACE memo significantly reduced the amounts of fill needed, Appendix 8 and 9 provide additional information about the conceptual locations and amounts of fill needed. The re-analysis of the recreation facilities is presented in Chapters 3 and 4.

Source: U.S. Corps of Engineers

Two other considerations also led to revision of the 2004 report. One is an evaluation of the feasibility of protecting the gravel pond just south of the Kingfisher Use Area with a system of constructed dikes. The gravel pond, which would be inundated at an elevation of 5444', supports a number of special uses and provides a unique setting for park visitors.

The proposed recreation facilities modification plan includes provisions to protect this pond, as discussed in Chapter 3 and detailed further in Appendix 3. Finally, the reallocation plan documented in this report more specifically assesses the need for replacing the anchoring system and winches at the marina. The results of this evaluation are described in Chapter 3 and Appendix 3.

A feasibility study on the Reallocation Project has been underway for several years and will evaluate a number of factors, including potential changes to downstream flows and to reservoir pool elevations as well as the potential consequences to water supplies, flood damages, recreation opportunities, water quality and fish and wildlife habitat. Historical stream flow records will be utilized to test the effects of different flood control and water supply regulation scenarios. The end product will be a feasibility report, including an Environmental Impact Statement (EIS), U.S. Fish and Wildlife Coordination Act Report, archeological assessment, public notice, and exhibits and supporting appendices for the study.

This recreation facilities modification plan is one element of these on-going studies. A crucial part of developing a recreation facilities modification plan for Chatfield State Park is developing an understanding of the park under historic operating conditions, including the relationship between water levels and existing facilities and how visitors use the park in an overall sense. This understanding has been combined with a review of potential modifications to the historic operating regime, as defined in the Chatfield Reservoir Reallocation Study. Through this comparison, potential effects have been identified, including specific facility and use area issues, as well as more general effects associated with the quality of the recreational experience and how this might be influenced by a new reservoir operational framework.

REPORT ORGANIZATION AND CONTENT

This report is organized in four Chapters. Chapter 2, following this Introduction, describes characteristics of the site and management of the reservoir, as well as the State Park. Chapter 3 describes the reallocation plan for an increased water level in the reservoir as well as the impacts it would cause to park facilities and programs. Chapter 3 also provides conceptual designs for the relocation of recreation sites, facilities, and other infrastructure. Chapter 4 provides a cost estimate for the redevelopment of recreation sites, facilities, and other infrastructure. This chapter also reviews other revenue related issues, including the potential for revenue losses during the period when construction is occurring for the redevelopment of park facilities and sites. An appendix provides more detail on the cost estimate, roadway analysis, and other plan considerations.

Chapter 2. Site Characteristics

Chatfield Reservoir is owned and operated by the USACE. The Reservoir was completed in 1976 for purposes of flood protection for the metropolitan Denver area following the disastrous South Platte flood of 1965. The recreation rights to the reservoir are leased by Colorado State Parks from the USACE.

Chatfield State Park is about 5,300 acres in size and includes approximately 1,500 surface-acres of water. More than 1.5 million visits occur at the park each year; the most popular recreation activities include hiking, fishing, biking, picnicking, swimming, model airplane flying, horseback riding, boating, hot air ballooning, bird watching, wildlife viewing, and environmental education programs.

Chatfield is one of the most complete parks in Colorado. Major facilities include 197 campsites, 10 group sites, 4 major group picnic areas, 139 family picnic sites, 3 major boat ramps, 20 miles of hard surface trail, 2,528 parking spaces, 33.3 miles of paved roadway, 9.6 miles of unpaved roadway, 38 restrooms, 6 shower buildings, a maintenance shop, and a swim beach complex. In addition, the park includes a full-service livery, the Chatfield marina, and one of the most popular hot-air balloon launch areas on the Front Range.

A graphic indication of the distribution and range of recreational facilities is provided in Map 2.1 on the following page.

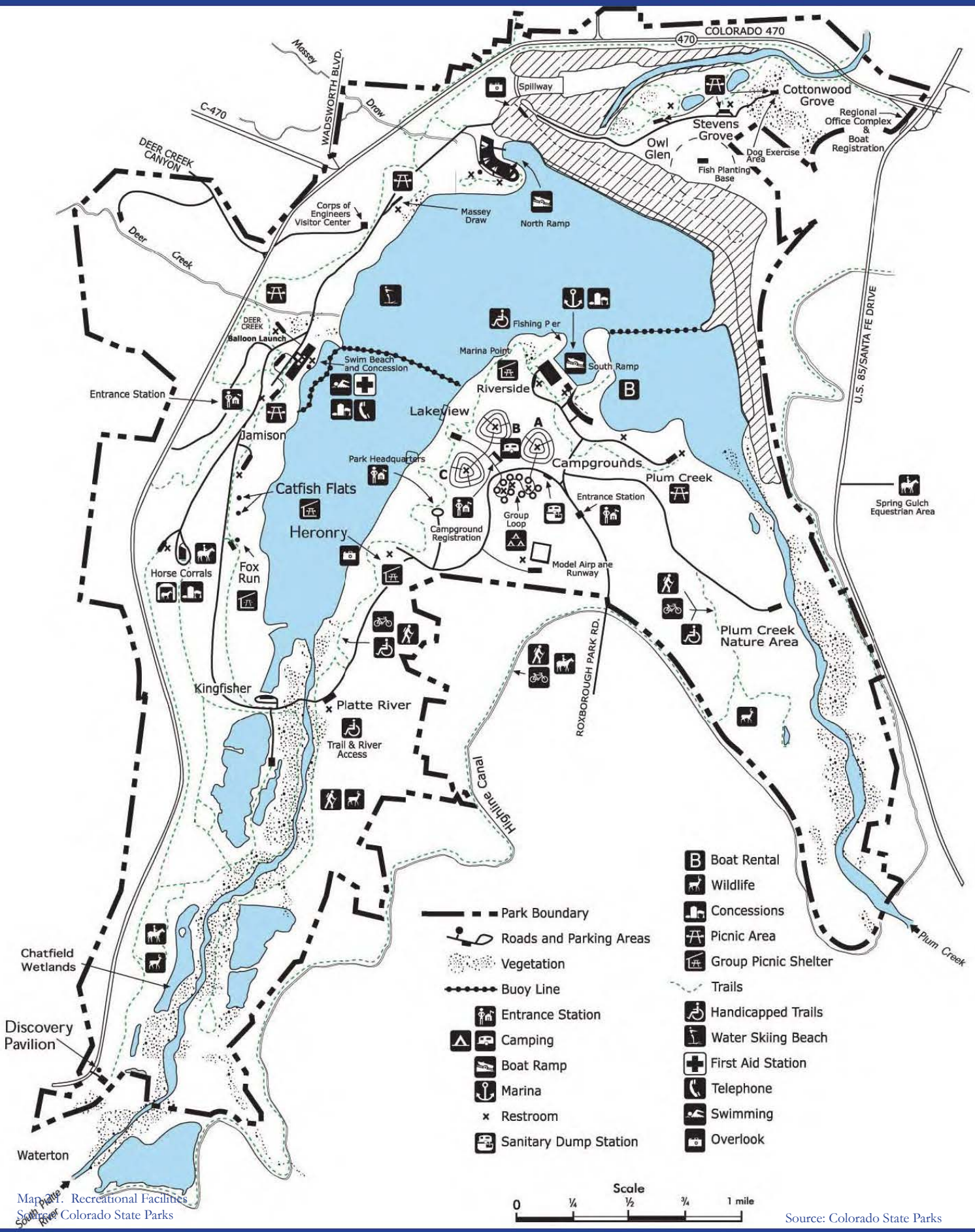
FLOOD HISTORY

During the early to mid-1900s, flooding on the South Platte repeatedly caused damage in the Denver metro area. Flooding occurred in 1933, 1935, 1942, and 1965. In order to address this problem, the USACE began construction on the Chatfield dam in 1967. Since its construction, the reservoir has stored water on several occasions that otherwise would have contributed to downstream flooding. The aerial photo below depicts the reservoir at an elevation 5443.1', which is more than 10-ft above the normal maximum elevation of 5432'. As can be seen in the photo, the high water that occurred on June 4, 1980 inundated many of the state park's developed use areas and facilities. Remarkably, the water elevation shown in the photo is less than a foot below the operating level addressed in this reallocation study, thus providing a good indication of what areas would be affected by an increase to 5444'.

EXISTING AND POTENTIAL RESERVOIR OPERATIONS

Chatfield Reservoir has a maximum depth of about 45-ft to 50-ft and an average depth of 24-ft (Weber 1990a, Babcock 1987). Water levels in the reservoir vary in response to climatic conditions and other factors, but in general the reser-

Aerial photograph from 1980 showing a flood at 5443' elevation. Notice that there were fewer facilities at this time, and some are inundated.
Source: U.S. Army Corps of Engineers



Map 2.1. Recreational Facilities
Source: Colorado State Parks

voir has been managed to maintain water levels within a 9-ft range (elevation 5425' to 5434') (USACE 2000). From 1976 to 1996, the change in water level was within this 9-ft range approximately 80 percent of the time. The average range of mean monthly elevations is small, less than 3-ft from low to high lake periods.

An important element of the Chatfield Reservoir Storage Reallocation Project studies was the modeling of various potential operation scenarios (Chatfield Reallocation Study Storage Use Patterns, Brown and Caldwell, 2003). A key conclusion of this study states: ". . . there is additional storage space available in Chatfield Reservoir, and . . . there are sufficient water rights and demand to utilize this additional storage." Although several scenarios were modeled in the Brown and Caldwell study, the recreation relocation study described in this report is based on the highest water elevation scenario, which would result in raising the reservoir to an elevation of 5444', or approximately 12-ft above the existing normal maximum operating level of 5432'. Updated model results are described later in this section.

Map 2.2 is an aerial photo of the reservoir with a colored line that depicts a water elevation of 5444'. A general sense of what recreation use areas would be affected by this elevation can be derived from this map.

Key areas that would be affected include the following:

- North Boat Ramp
- Massey Draw
- Swim Beach Area
- Catfish Flats/Fox Run Group Use Areas
- Kingfisher/Gravel Ponds/Platte River Trailhead Areas
- Marina Area
- Plum Creek Area

The operating regime associated with a reservoir elevation at 5444' results in an increased frequency of larger, seasonal water surface fluctuations. Table 2.1 summarizes the increase in magnitude of seasonal water surface elevation fluctuation over the 59-year period of record that was modeled. The average recreational season (June through September) water surface elevation fluctuation with historic operations and the existing normal high water elevation of 5432' is 6.7-ft. The raised water surface alternative (5444') increases the average recreational season fluctuation to 11.9-ft – an increase of 5.2-ft.

Table 2.1. June through September Water Surface Fluctuation

Reservoir Water Surface	Average Water Surface Fluctuation (ft)	Years with more than 15-Ft Fluctuation (out of 59-year record)
5432' (historic operations)	6.7	5
5444' (modeled results for Chatfield Reallocation Projects)	11.9	20
Source: USACE Model Results		

A more significant operations challenge may be presented by larger fluctuations that occur infrequently but regularly. Over the 59-year historic period of record (1942 to 2000) that was modeled, historic operations (5432') had 5 years with more than 15-ft of fluctuation. In contrast, the 5444' alternative has 20 years when the water surface elevation fluctuation is greater than 15-ft.

Figures 2.1 and 2.2 (page 2-5) show the yearly difference between the seasonal maximum (red dash) and seasonal minimum (blue dash) water surface elevations.

Some key conclusions are noted below:

- Raising the reservoir elevation from 5432' to 5444' results in higher water surface elevations throughout the recreational season. With the new operating regime modeled for a reservoir at 5444', the surface area of the reservoir would increase and the amount of area available for boating, fishing and other activities would be larger at all times of the year as well as under all hydrological conditions that were modeled over the 59-year period of record.
- By modifying the reservoir storage and management practices, operations of park facilities and use areas will need to deal with potential water surface elevations regularly ranging from 5444' to 5426'. This creates a need to relocate major facilities above the 5444' water level. Facilities such as the parking lots, restrooms, and other buildings would need to be relocated above the normal high water line.

Another consideration is the frequency that lower water conditions would occur during the primary recreation season. As shown in Figure 2.2, a level of approximately 5428' or less would be reached 15 times over the 59 year period of record, which equates to a frequency of approximately once every 4 years. The 5426' elevation was used as a low level

Map 2.2. Base Map

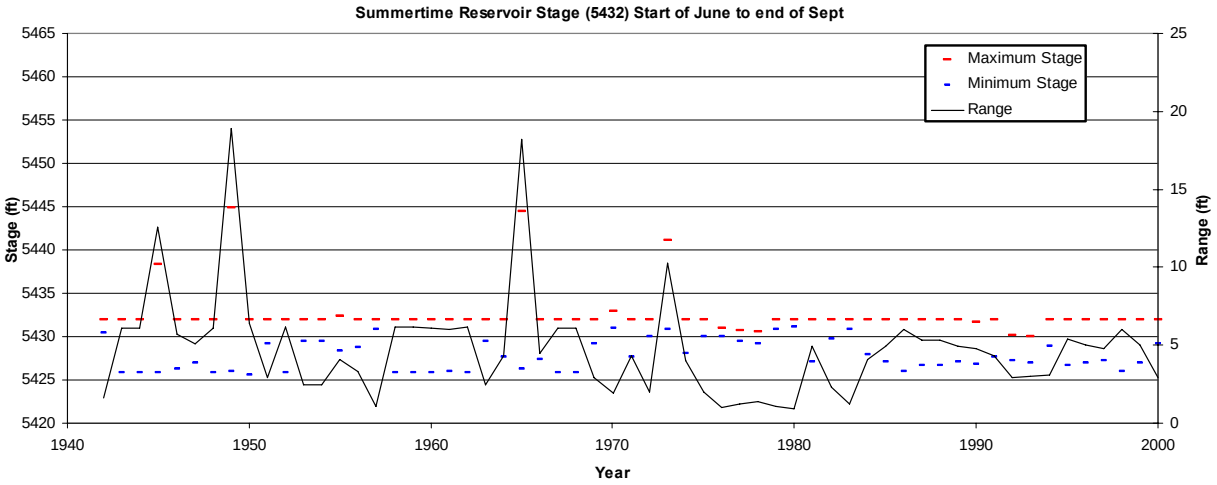


Figure 2.1. Seasonal Max and Min Water Surface, Historic Operations (5432')

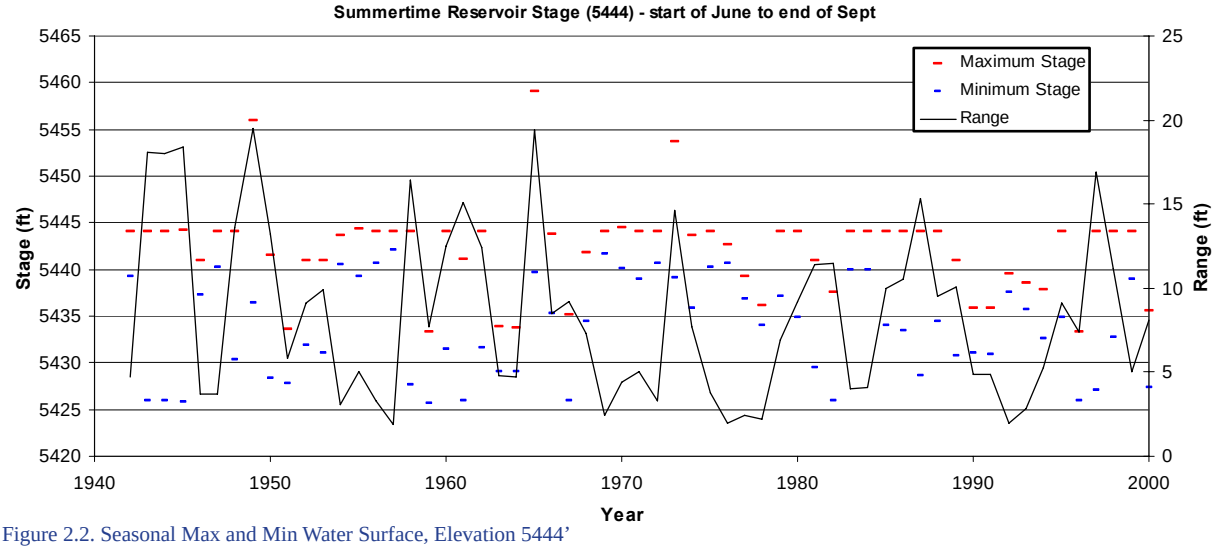


Figure 2.2. Seasonal Max and Min Water Surface, Elevation 5444'

barometer as and shown on the site maps to illustrate the distance between the high water level of 5444' and regularly occurring low water levels. On occasion, the water level will drop below 5426' during the primary recreation season between May 1 and August 31.

In addition, portions of the park road system would be inundated, including the segment crossing Deer Creek, several segments in the swim beach vicinity, and the crossing of the Platte River at the south end of the existing reservoir.

Additional details on facility effects are provided later in this section.

Affected Recreational Use Areas and Facilities

The discussion that follows focuses on the affected use areas and provides an area-by-area description of what facilities would have to be relocated or redeveloped. Areas that would not be directly influenced by inundation, such as the campgrounds, are not considered in this discussion. The areas that would be affected include the following:

- North Boat Ramp
- Massey Draw
- Swim Beach Area
- Catfish Flats/Fox Run Group Use Areas
- Kingfisher/Gravel Ponds/Platte River Trailhead Areas
- Marina Area
- Plum Creek Area

These recreational use areas and the other natural areas that are at or below the 5444' contour make up a loss of approximately 573 acres of upland vegetation habitat.

North Boat Ramp

This is the only formal boat launch area on the west side of the reservoir. It includes two ramps, paved parking and circulation areas, and a variety of support facilities. The area also includes a series of picnic shelters. Table 2.2. provides a complete listing of facilities in the area, noting which of these would be influenced by a water level increase to 5444'.

Map 2.3. is an aerial photo depicting the area with the 5444' water elevation shown. As can be seen in the photo, the two existing boat ramps would largely be inundated and several of the picnic shelters would also be affected. Remaining areas, including most of the parking and circulation roads, would remain above the normal high water line.

Table 2.2. North Boat Ramp Inventory

Item	Unit	Unit Quantity	Inundation at Elevation 5444'
Parking Areas			
Asphalt	SF	400,000	Partial inundation
Boat Ramps			
Concrete	SF	16,800	Yes
Docks	Each	4	NA
Trails			
Concrete Trails	SF	60,000	Partial inundation
Architecture			
Restroom Building -West	Each	1	NO
Restroom Building	Each	1	NO
Day Use Shelter	Each	4	YES
Day Use Shelter - West	Each	4	NO
Information Kiosk	Each	2	NO
Furniture			
Picnic Tables	Item	32	50%
Benches	Item	1	NO
Water Fountain	Item	4	NO
Dumpsters	Item	3	NO
Trash Receptacles	Item	7	50%
Bollards	Item	4	YES
Grills	Item	8	50%
Regulatory Signs	Item	46	30%
Utilities			
Water Hydrants	Item	2	50%
Lift Station	Item	2	NO
Telephone	Item	1	NO
Electrical			
Transformers	Item	1	NO
Light Poles	Item	26	NO

Map 2.3. North Ramp Existing Conditions

Massey Draw

Massey Draw is another popular use area located in the vicinity of the North Boat Ramps. Facilities located in this area are also listed in Table 2.3. and depicted in Map 2.4. The beach area, including a volleyball court and horseshoe pits, would be inundated at 5444'.

Table 2.3. Massey Draw Inventory

Item	Unit	Unit Quantity	Inundation at Elevation 5444'
Parking Area			
Gravel	SF	34,000	NO
Wheel Stops	Item	34	NO
Trails			
Asphalt Trails	SF	9,304	50%
Architecture			
Restroom Building	Each	1	NO
Furniture			
Picnic Tables	Item	8	YES
Benches	Item	3	YES
Dumpsters	Item	2	NO
Trash Receptacles	Item	3	YES
Grills	Item	8	YES
Regulatory Signs	Item	12	NO
Fencing	LF	487	NO
Recreational Facilities			
Beach Volleyball Court	Item	1	YES
Horse Shoe Pits	Item	2	YES

Map 2.4. Massey Draw Existing Conditions

Swim Beach Area

Eagle Cove/Deer Creek

The Swim Beach Area also includes the Deer Creek Area with its balloon launch facilities and day use sites. The balloon launch area is very popular and hosts an annual balloon festival that attracts thousands of visitors. Facilities in this area are listed in Table 2.4. and depicted in Map 2.5. An increase in water elevation to 5444' would inundate most of the area and require that these facilities be developed at another location.

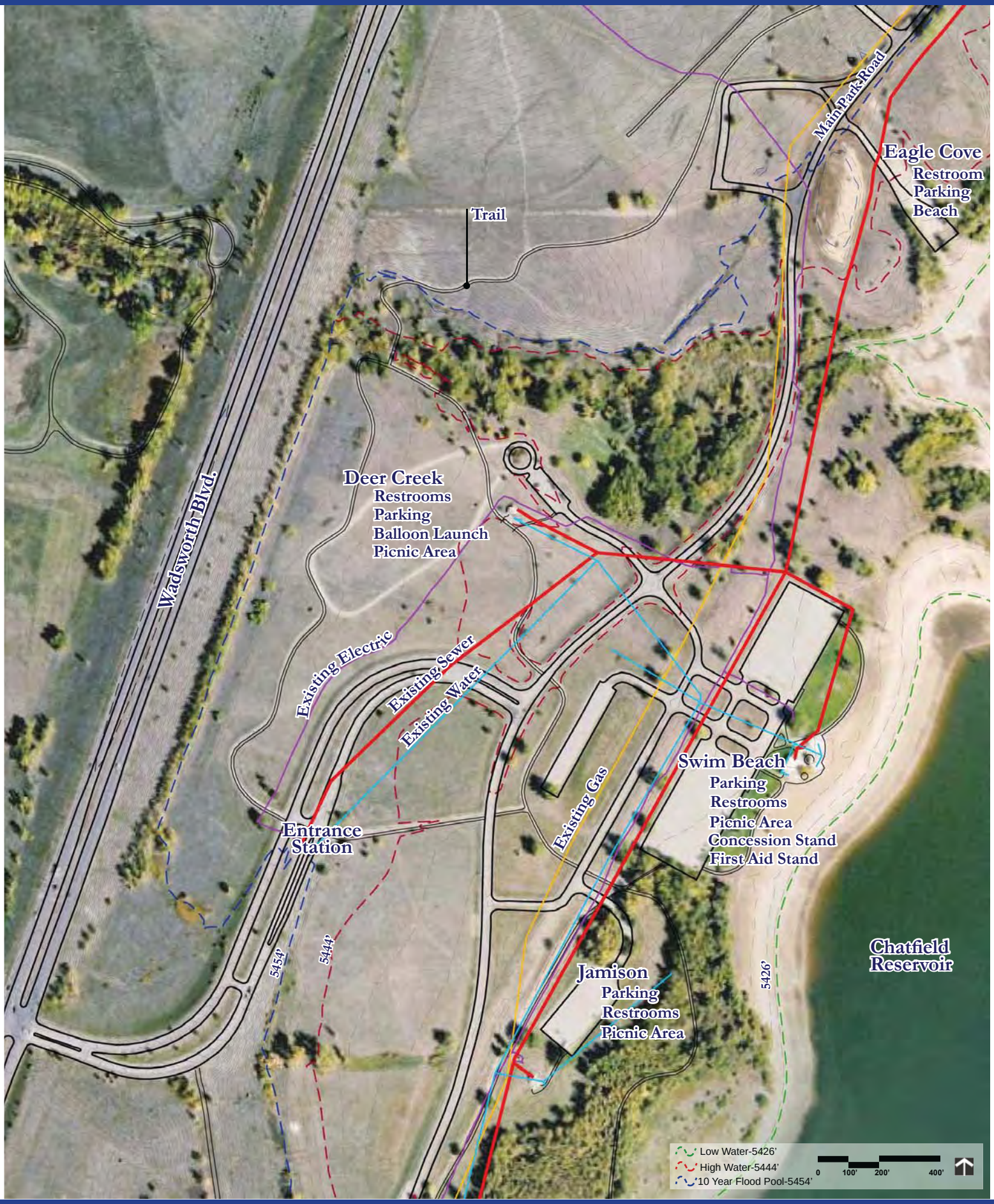
Another use area in this vicinity is Eagle Cove, which is located just north of Deer Creek. The limited facilities in this area are listed in Table 2.5. and illustrated in Map 2.5. All of the facilities in this area would have to be relocated.

Table 2.5. Eagle Cove Inventory

Item	Unit	Unit Quantity	Inundation at Elevation 5444'
Parking Area			
Wheel Stops	Item	29	YES
Gravel	SF	13,000	75%
Architecture			
Portable Restroom	Each	1	YES
Furniture			
Dumpsters	Item	1	YES
Trash Receptacles	Item	1	YES
Regulatory Signs	Item	2	YES
Fencing	LF	84	YES

Table 2.4. Deer Creek Inventory

Item	Unit	Unit Quantity	Inundation at Elevation 5444'
Parking Area			
Asphalt	SF	26,000	50%
Gravel Staging Road	SF	34,000	NO
Wheel Stops	Item	28	50%
Trails			
Concrete Trails	SF	18,000	YES
Foot Bridge	LF	15'	YES
Architecture			
Restroom Building	Each	1	NO
Information Kiosk	Each	1	NO
Furniture			
Picnic Tables	Item	12	YES
Benches	Item	1	NO
Water Fountain	Item	2	NO
Dumpsters	Item	1	NO
Bollards	Item	4	NO
Trash Receptacles	Item	2	YES
Grills	Item	11	YES
Regulatory Signs	Item	5	50%
Wind Sock	Item	1	
Landscape			
Landscaped Island	SF	3,421	NO
Decorative Stone Retaining Wall	LF	54	NO
Utilities			
Water Hydrants	Item	1	NO
Electrical			
Transformers	Item	1	NO



Map 2.5. Swim Beach Area Existing Conditions

Swim Beach

This is a key use area that is heavily visited. Swimming is the most popular visitor activity at Chatfield State Park. Major development has occurred in this area, including large parking areas, a swim beach with graded slopes and sand, and a wide variety of support facilities such as restrooms, concession buildings, and others. The area also includes an extensive network of walkways and trails. Facilities are itemized in Table 2.6.

As shown in Map 2.5., all of this area would be inundated at a water elevation of 5444' and would have to be relocated.

Table 2.6. Swim Beach Inventory

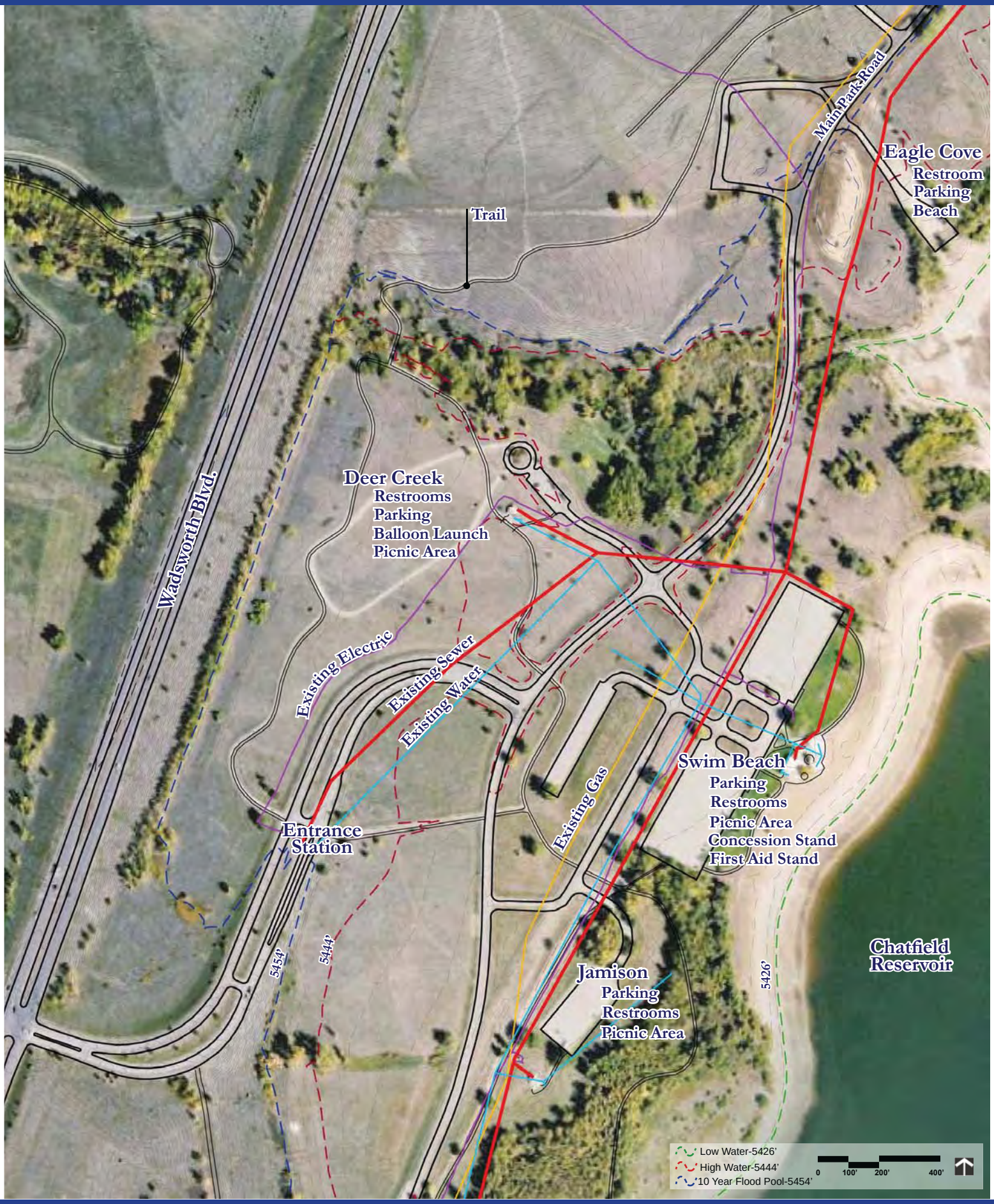
Item	Unit	Unit Quantity	Inundation at Elevation 5444'
Parking Area			
Asphalt	SF	238,000	YES
Wheel Stops	Item	274	YES
Trails			
Concrete Trails	SF	5,112	YES
Architecture			
Swim beach Shower/ Restroom Building	Each	1	YES
Swim beach Concession Building	Each	1	YES
Swim beach First Aid Station	Each	1	YES
Information kiosk	Each	2	YES
Furniture			
Picnic Tables	Item	12	YES
Benches	Item	7	YES
Water fountain	Item	2	YES
Dumpsters	Item	4	YES
Trash Receptacles	Item	10	YES
Bollards	Item	6	YES
Grills	Item	8	YES
Regulatory Signs	Item	17	YES
Fencing	LF	929	YES
Recreational Facilities			
Lawn	SF	80,000	YES
Beach Volleyball Court	Item	0	YES
Horse Shoe Pits	Item	0	YES
Sand	CY	6,500	YES
Utilities			
Water Hydrants	Item	2	YES
Lift Station	Item	1	YES
Telephone	Item	2	YES
Electrical			
Light poles	Item	1	YES
Electrical Transformer	Item	2	YES

Jamison Group Use Area

Just south of the swim beach Areas is the Jamison Group Use Area, which includes a parking area, restroom, and picnic tables. All of these would be inundated at 5444'.

Table 2.7. Jamison Inventory

Item	Unit	Unit Quantity	Inundation at Elevation 5444'
Parking Area			
Asphalt	SF	41,500	YES
Wheel Stops	Item	61	YES
Trails			
Concrete Trails	SF	30,000	YES
Architecture			
Jamison Restroom	Each	1	YES
Furniture			
Picnic Tables	Item	4	YES
Benches	Item	1	YES
Water fountain	Item	2	YES
Dumpsters	Item	1	YES
Trash Receptacles	Item	1	YES
Grills	Item	4	YES
Regulatory Signs	Item	9	YES
Utilities			
Lift Station	Item	1	YES
Electrical			
Electrical Transformer	Item	1	YES



Map 2.5. Swim Beach Area Existing Conditions

Catfish Flats/Fox Run Group Use Areas

These areas consist of a series of group use areas that include picnic shelters, restrooms, parking, and related facilities. A complete listing of facilities is provided in Tables 2.8. and 2.9. Map 2.6. depicts the relationship between these facilities and a water elevation of 5444'. At this water elevation, all of these facilities would be inundated and they would have to be redeveloped at another location. Portions of the trail system would also have to be redeveloped.

Table 2.8. Catfish Flats Inventory

Item	Unit	Unit Quantity	Inundation at Elevation 5444'
Parking Area			
Asphalt	SF	61,000	YES
Wheel Stops	Item	79	YES
Trails			
Concrete Trails	SF	18,392	YES
Architecture			
Restroom Building	Each	1	YES
Group Picnic Area 1 (closest to parking)			
Walls	LF	135	YES
Group Shelters	Each	1	YES
Gravel Pavement	SF	3,450	
Picnic Tables	Item	10	YES
Electrical Hookup	Each	0	
Group Picnic Area 2 (furthest from parking)			
Walls	LF	135	YES
Group Shelters	Each	1	YES
Gravel Pavement	SF	3,000	
Picnic Tables	Item	8	YES
Electrical Hookup	Each	0	
Furniture			
Picnic Tables	Item	5	YES
Benches	Item	1	YES
Water fountain	Item	2	YES
Dumpsters	Item	1	YES
Trash receptacles	Item	1	YES
Regulatory Signs	Item	9	YES
Utilities			
Water Hydrants	Item	3	YES
Lift Station	Item	1	YES
Electrical			
Electrical Transformer	Item	1	YES

Table 2.9. Fox Run Inventory

Item	Unit	Unit Quantity	Inundation at Elevation 5444'
Parking Area			
Gravel	SF	31,000	NO
Trails			
Concrete Trails	SF	47,688	50%
Architecture			
Portable Restrooms	Each	2	NO
Group Picnic Area			
Walls	LF	135	YES
Group Shelters	Each	1	YES
Gravel Pavement	SF	3,450	YES
Picnic Tables	Item	8	YES
Electrical Hookup	Each	0	
Furniture Group Shelters			
Picnic Tables	Item	0	YES
Benches	Item	0	YES
Water Fountain	Item	0	YES
Dumpsters	Item	1	YES
Trash Receptacles	Item	2	YES
Regulatory Signs	Item	5	50%
Fencing	LF	716	NO
Recreational Facilities			
Beach Volleyball Court	Item	1	YES
Horse Shoe Pits	Item	2	YES
Utilities			
Water Hydrants	Item	1	NO

Map 2.6. Catfish Flats/Fox Run
Group Use Areas Existing Conditions

Kingfisher/Gravel Ponds/Platte River Trailhead Areas

A variety of uses occur at this end of the reservoir, especially around the gravel ponds that lie between the reservoir and the main park road that leads to the Campground and Marina Area. The large gravel pond is used by dog training clubs, non-motorized boaters, fishermen, and others. There are relatively few developed facilities in this area, primarily parking areas and trails. These are listed in Tables 2.10. - 2.12. Map 2.7. shows the area in detail and highlights the fact that all existing facilities in this area would be inundated at 5444'.

Table 2.10. Kingfisher Area Inventory

Item	Unit	Unit Quantity	Inundation at Elevation 5444'
Parking Area			
Gravel	SF	38,000	YES
Wheel Stops	Item	28	YES
Furniture			
Portable Restrooms	Each	1	YES
Dumpsters	Item	1	YES
Trash Receptacles	Item	1	YES
Regulatory Signs	Item	3	YES
Fencing	LF	375	YES

Table 2.11. Gravel Ponds Area Inventory

Item	Unit	Unit Quantity	Inundation at Elevation 5444'
Parking Area			
Gravel	SF	86,500	YES
Wheel Stops	Item	38	YES
Architecture			
Portable Restrooms	Each	1	YES
Furniture			
Picnic Tables	Item	4	YES
Dumpsters	Item	1	YES
Trash Receptacles	Item	1	YES
Regulatory Signs	Item	18	YES
Fencing	LF	596	YES

Table 2.12. Platte River Trailhead Area Inventory

Item	Unit	Quantity	Inundation at Elevation 5444'
Parking Area			
Asphalt	SF	19,000	NO
Wheel Stops	Item	87	NO
Trails			
Concrete Trails	SF	9,000	50%
Architecture			
Restroom Building	Each	1	NO
Furniture			
Picnic Tables	Item	0	NO
Benches	Item	2	NO
Dumpsters	Item	0	NO
Trash receptacles	Item	2	NO
Regulatory Signs	Item	7	NO
Fencing	LF	743	NO

Map 2.7. Kingfisher/Gravel Ponds/ Platte River Areas Existing Conditions

Marina Area

This is a major use area that has been extensively developed. The area includes the marina itself, a fishing pier, extensive paved parking areas, a boat ramp, group picnic sites, and an extensive network of walkways and trails. A detailed list of facilities is provided in Table 2.13.

Map 2.8. shows the area in detail and depicts the 5444' water elevation. Nearly all of the existing facilities in this area would be affected by an increase in the water level to 5444' and most of the area would have to be redeveloped.

Table 2.13. Marina Area Inventory

Item	Unit	Unit Quantity	Inundation at Elevation 5444'
Boat Ramp - concrete	SF	4,750	YES
Parking Area			
Asphalt	SF	148,000	YES
Wheel Stops	Item	36	YES
Trails			
Concrete Trails	SF	7,000	YES
Architecture			
Concessions Building	Each	1	YES
Shower/ Restroom Building	Each	1	YES
Day Use Shelter	Each	1	YES
Information Kiosk	Item	1	YES
Riverside Marina Slips	Item	320	YES
Group Picnic Area			
Walls	LF	135	YES
Group Shelters	Each	2	YES
Concrete Pavement	SF	5,088	YES
Picnic Tables	Item	10	YES
Electrical Hookup	Each	2	YES
Furniture			
Picnic Tables	Item	10	YES
Benches	Item	1	YES
Water Fountain	Item	1	YES
Dumpsters	Item	4	YES
Trash Receptacles	Item	4	YES
Regulatory Signs	Item	37	YES
Recreational Facilities			
Beach Volleyball Court	Item	1	YES
Horse Shoe Pits	Item	2	YES

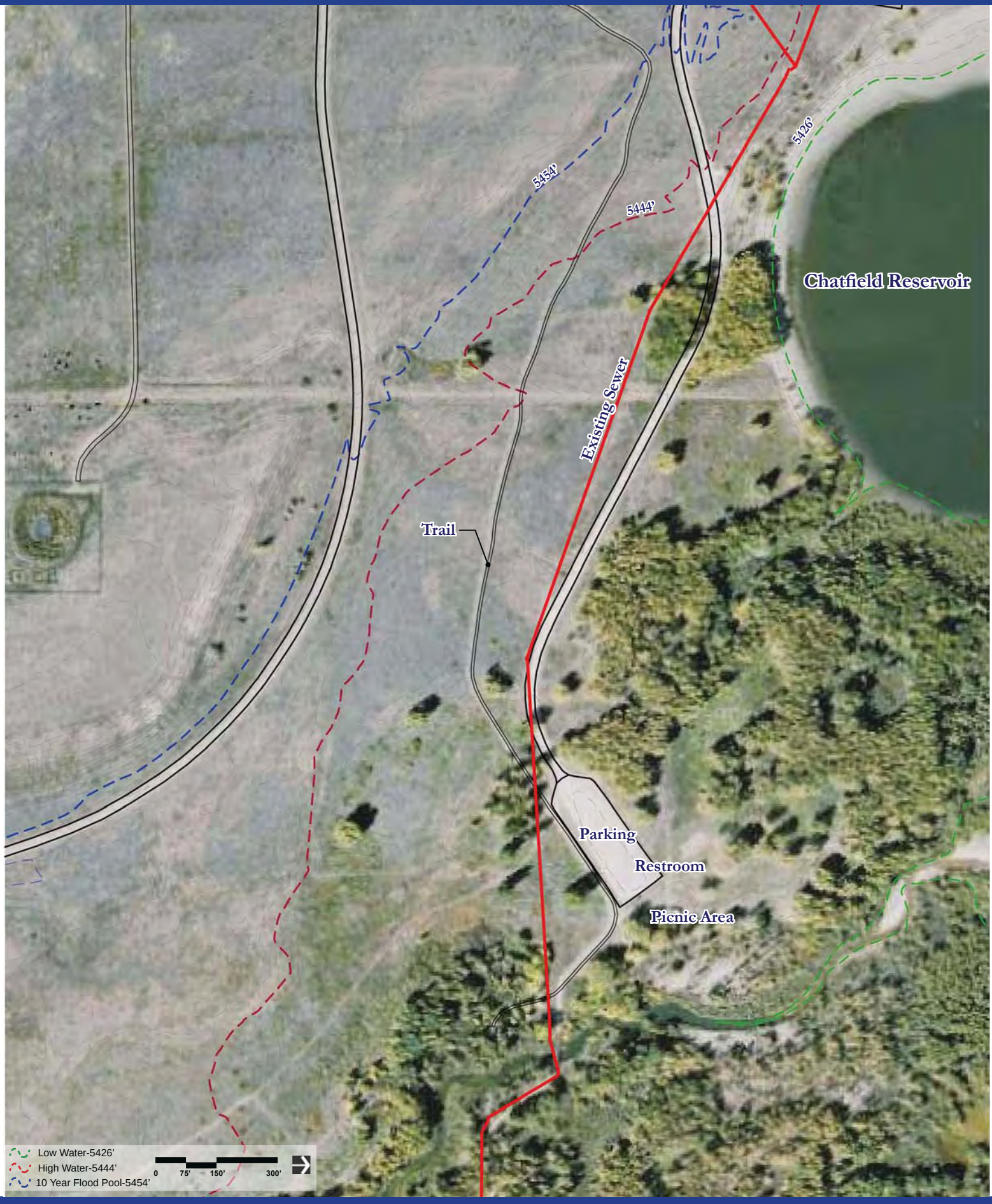

Campground
5454'
Trail
5444'
Picnic Shelter
Parking
Restroom
Picnic Shelter
Parking
Fishing Pier
5426'
Trail
Storage
Picnic Shelter
Restroom
Marina
Existing Water
Parking
Boat Ramp
Chatfield Reservoir
Existing Sewer
Existing Electric
Low Water-5426'
High Water-5444'
10 Year Flood Pool-5454'
0
75'
150'
300'

Plum Creek Area

This area serves as a trailhead and also has a day use area with tables, a restroom, and parking. A list of facilities in this area is provided in Table 2.14. Map 2.9. shows the current area layout.

Table 2.14. Plum Creek Inventory

Item	Unit	Unit Quantity	Inundation at Elevation 5444'
Parking Area			
Gravel	SF	35,000	YES
Trails			
Concrete Trails	SF	7,200	YES
Architecture			
Restroom Building	Each	1	YES
Furniture			
Picnic Tables	Item	11	YES
Benches	Item	1	YES
Dumpsters	Item	1	YES
Regulatory Signs	Item	2	YES
Fencing	LF	697	YES
Recreational Facilities			
Volleyball	Item	1	YES


5454'
5444'
5426'
Chatfield Reservoir
Existing Sewer
Trail
Parking
Restroom
Picnic Area
Low Water-5426'
High Water-5444'
10 Year Flood Pool-5454'
0
75'
150'
300'

VISITATION CHARACTERISTICS

Key characteristics of visitation to Chatfield State Park are summarized in this section.

Swimming is the most popular activity, followed by boating. Hiking, fishing and camping are also very popular activities. Visitor activity preferences are summarized below:

Activity Participation Rates	
Hiking	23%
Fishing	21%
Picnicking	24%
Photography	7%
Visitor Center	1%
Swimming	41%
Motorized Boating	35%
Bicycling	11%
Camping	18%
Wildlife/Nature Observations	11%

Source: State Parks Market Assessment, 2003

The age distribution of visitors to Chatfield is concentrated among three age groups. The great majority (76%) are between 25 and 54, with the 35-44 age group representing the largest single age group. These statistics are summarized below:

Demographic Profile of Visitors	
18-24 years old	4%
25-34 years old	22%
35-44 years old	32%
45-54 years old	22%
55-64 years old	10%
65 + years old	9%

Source: State Parks Market Assessment, 2003

Visitation to Chatfield occurs year-round but is concentrated in the summer months. More than one half of total annual visits occurs during the four month period of May-August. Visitation distribution for the year 2003 is summarized in Table 2.15.

Table 2.15. Monthly Visitation to Chatfield State Park in 2003

Month	Visitors	Seasonal Distribution
January	74,179	5%
February	70,995	5%
March	78,108	5%
April	133,983	9%
May	191,702	12%
June	229,053	15%
July	217,736	14%
August	226,922	14%
September	136,312	9%
October	84,846	5%
November	58,366	4%
December	34,378	4%
Total	**1,566,580**	**100%**

Source: Chatfield State Parks Manager's Reports for 2003

NATURAL RESOURCES

Natural resources were considered in the development of the reallocation plan. A summary of these resources is provided in this section. For the most part, sensitive resource areas are not located adjacent to developed use areas at the park, and facilities and use areas can be relocated without creating resource conflicts. An exception to this statement is associated with redevelopment of the roadway system, particularly the new crossing of the South Platte that would be required by raising the water to elevation 5444' (source: Brown and Caldwell, 2003).

For more information in regards to wildlife plants and other elements of the natural environment, please refer to the Environmental Assessment being prepared by ERO and TetraTech.

Cultural Resources

An inventory of cultural resource sites prepared by the USACE (USACE 2007) was reviewed to determine if known cultural resource sites would be affected by the reallocation plan. Based on this review, any cultural resource sites impacted by this plan will be handled according to USACE, and the Colorado State Historical Preservation Office guidelines. However, as more detailed plans are developed and construction sites are better defined, the inventory will be further reviewed.

Chapter 3. Recreation Facilities Modification Plan

This section presents conceptual designs for the relocation and redevelopment of park facilities that would be impacted by raising the water level of Chatfield Reservoir. As previously discussed, impacts to park facilities and programs were based on a future normal high water elevation of 5444'. Major facilities, such as buildings, main roadways, and major utilities including an Xcel gas line, forced sewer lines and water lines which had to be relocated or redeveloped, were located above or outside the 5444' elevation and provided with an additional buffer of three vertical feet, i.e., a base elevation of 5447'. As previously mentioned, USACE granted an exception to existing policy, allowing functionally-dependent structures to be located within the 10-year flood pool. This is discussed further in Appendix 6.

Any facilities or use areas that fell below, or close to, elevation 5444' were evaluated for replacement or adjustment. In some cases, an existing parking area or boat ramp would only need to be partially modified to accommodate the future water level.

An important assumption that guided the conceptual design effort was that no facility or program area would lose any capacity or functionality as the result of relocation or modification. Put another way, the recreation modification plan provides for in-kind replacement of facilities affected by higher water levels. Design and development of replaced facilities would be completed under current building codes, Colorado State Parks building requirements, and to meet American Disability Act (ADA) requirements for public facilities.

It must be emphasized that the recreation modification plan reflects a conceptual level of design. More detailed design will be required to address site-specific conditions and other design factors. Among these is the need to base the design on final reservoir operations modeling so that facility locations and features reflect the actual drawdown conditions that are anticipated after the reallocation project is further refined.

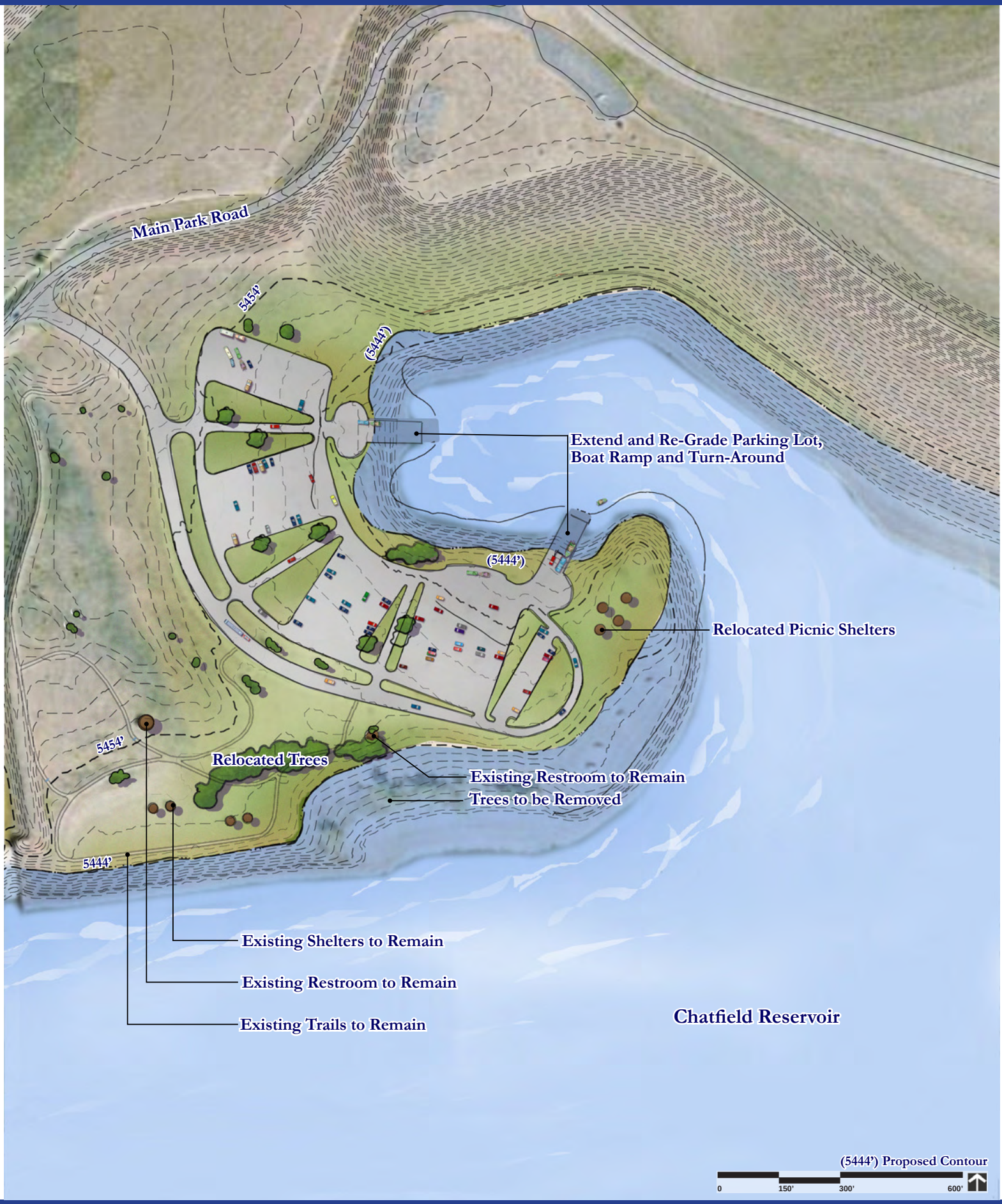
Based on conceptual level of design, costs for implementing the recreation relocation plan are presented in Chapter 4 and Appendix 1. A key assumption in developing the recreation modification plan is that fill material will be available from on-site sources and that this material can be obtained from locations below the high water line. Additional detail in regards to fill material locations, amounts and quality of the material is outlined in Appendices 8, 9, and 10, respectively.

During preliminary stages of this study, design alternatives were considered at varying levels of detail. Following review and discussion with Colorado State Parks and other study participants, a preferred concept was identified for each major use area. Only the preferred concepts are presented in this report. The following sections include detailed descriptions, recreation modification plan maps, and proposed solutions for each of the major use areas to the new high water pool elevation of 5444'.

NORTH BOAT RAMP

- Elevation 5444' results in partial inundation of this facility, with ramps becoming inoperable.
- Facilities affected include boat ramps, parking area, day use shelters, and trails.
- Boat ramps would be constructed to extend to the elevation of the existing ramps in order to operate at low water levels. The gradient (slope) on the new ramps would be reduced.
- Day use shelters and furniture would be relocated, as would trails.

This alternative requires a substantial amount of fill to raise a portion of the parking area. The resulting concept is illustrated in Map 3.1.

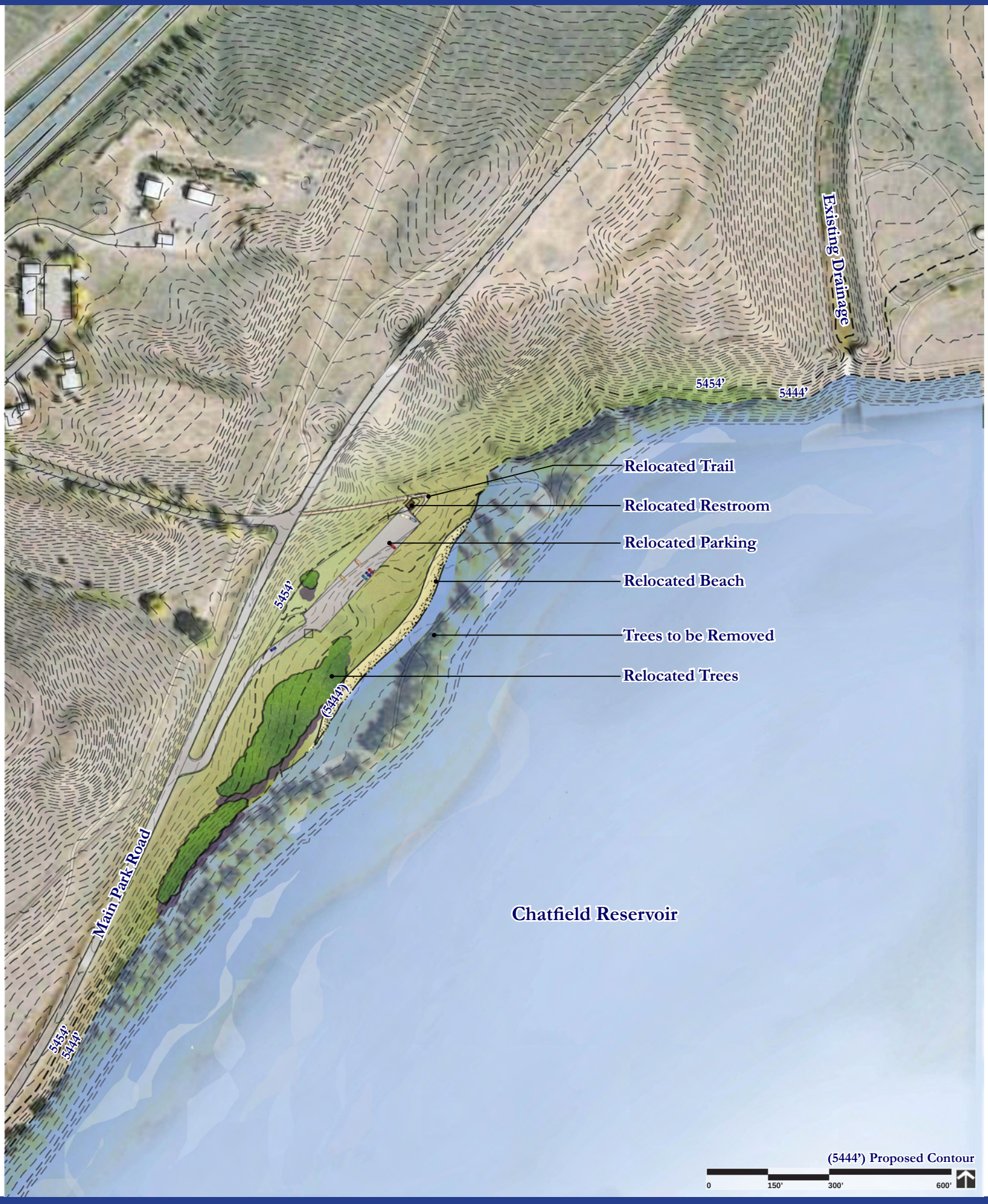


Map 3.1. North Boat Ramp Modification Plan (5444' Elevation)

MASSEY DRAW DAY USE AREA

- Raising the water level to 5444' severely reduces the recreation capacity of this area but does not inundate the existing parking area.
- While the existing vault restroom is currently above 5444', the service tank for the restroom is below the 5444'. Due to health code, the tank for the vault restroom would need to be relocated above 5444'.
- Relocation to this area would include importing fill material to raise the elevation above 5444' and create a usable recreational area in the same location with a similar amount of usable area that currently exists. Existing beach volleyball and horseshoe pits would be rebuilt. Furniture can be stored and relocated to the future area.

The resulting relocation concept is illustrated in Map 3.2.



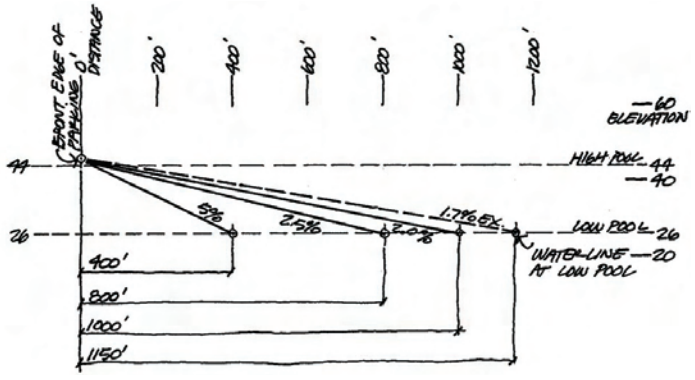
Map 3.2. Massey Draw Modification Plan (5444' Elevation)

SWIM BEACH AREA

Impacts in the Swim Beach Area are the most substantial of all facilities located along the shoreline. The entire Swim Beach site and associated parking area would be inundated and a number of other facilities would also be affected. The relocation concept is described below and is illustrated in Map 3.3.

Section 3.3A. illustrates some the challenge in designing a new Swim Beach with facilities above the 5444' elevation. As the gradient of the beach decreases, the distance between the water edge and on shore facilities such as the parking area increases during low water conditions. For example, at a low gradient slope, the water becomes approximately 1200-ft from the parking area when the reservoir reaches a water surface elevation of 5426'. Conversely, if the beach slope is graded to a steeper 5% slope, this distance drops to a distance less than 400-ft.

Although there is no universally accepted rule of thumb on how far park visitors will be willing to walk in order to reach the water edge, it clearly becomes more inconvenient to walk an increased distance with beach gear and other equipment. Given a goal of replacing affected facilities and use areas "in-kind", the relocation plan is based on maintaining current walking distances at the swim beach. This could result in higher development costs and potentially higher annual maintenance costs for sand replacement, etc. However, it would result in a recreation experience similar to current conditions and eliminate the need for implementing low water management strategies, such as providing temporary restrooms and temporary parking areas below the high water line. The costs shown in Chapter 4 and Appendix 1 are based on this type of design, one that grades the beach area to minimize the distance between shore facilities and the water edge at low water conditions.



Section 3.3A.

In addition to impacts to recreation facilities, a portion of the entrance road would need to be realigned and a major segment of the main park road would have to be located further inland. Realignment of the main park road would also require a new bridge crossing of Deer Creek. The new roadway alignments specific to the Swim Beach area are shown in Map 3.3 and discussed in more detail in Appendix 2. Roadway design criteria are presented later in this chapter. All utilities servicing this area would need to be relocated.

Swim Beach

- Swim beach area is completely inundated at 5444'.
- The facility would be relocated to the south west of the current facility. A swim beach area of similar quality to that which presently exists could be developed at this location.
- In order to construct a beach, the existing facility will need to be demolished and excavated. Sand will need to be saved and also imported to create the new beach environment. The excavated material will assist in filling low areas that would be inundated at 5444' to ensure these areas are usable at this proposed elevation.
- The current buildings, lawn area, and recreational facilities would be rebuilt in the new location.
- The proposed location would require the Chatfield interior road to be relocated. This road would be elevated to ensure operations at 5444' and, in the case of a flood event, higher.

Eagle Cove

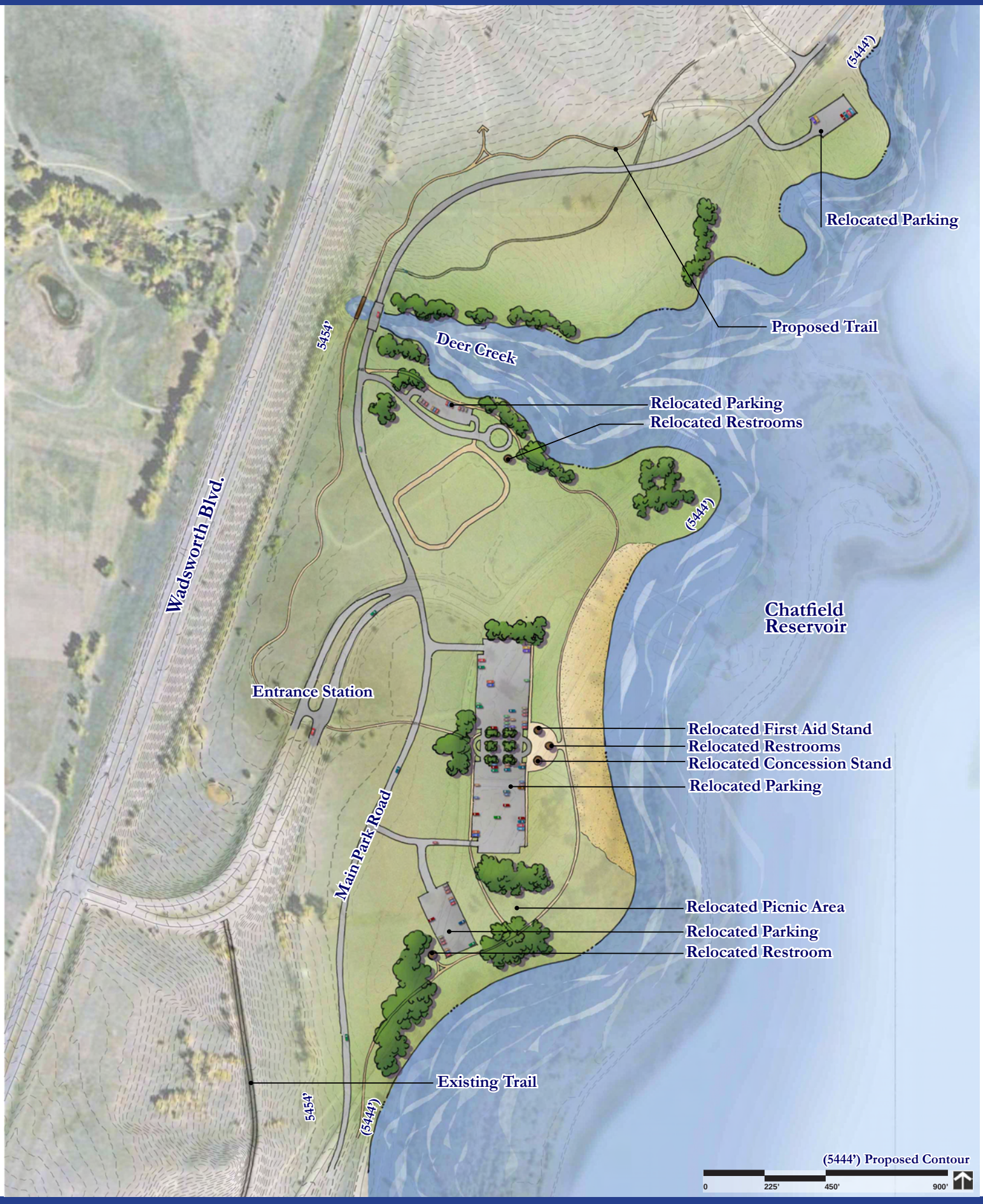
- The existing gravel parking lot and portable restroom are inundated at 5444'.
- The gravel parking lot will be redeveloped within the same general area at an elevation above 5444'.
- The use of additional fill should be minimized in this area due to existing grades above 5444'.

Deer Creek

- Much of the Deer Creek area, or approximately 50%, is inundated at 5444'.
- All existing facilities will be redeveloped within the same general area and elevation above 5444' through the use of fill.

Jamison Day Use Area

- The entire area is relocated south of current location. Parking and restroom facility will require replacement. Furniture can be relocated to the new location.



Map 3.3.1. Swim Beach Area Modification Plan (5444' Elevation)

Map 3.3.2. Swim Beach Area Modification Plan (5440' Elevation)

Map 3.3.3. Swim Beach Area Modification Plan (5426' Elevation)

CATFISH FLATS AND FOX RUN GROUP PICNIC AREAS

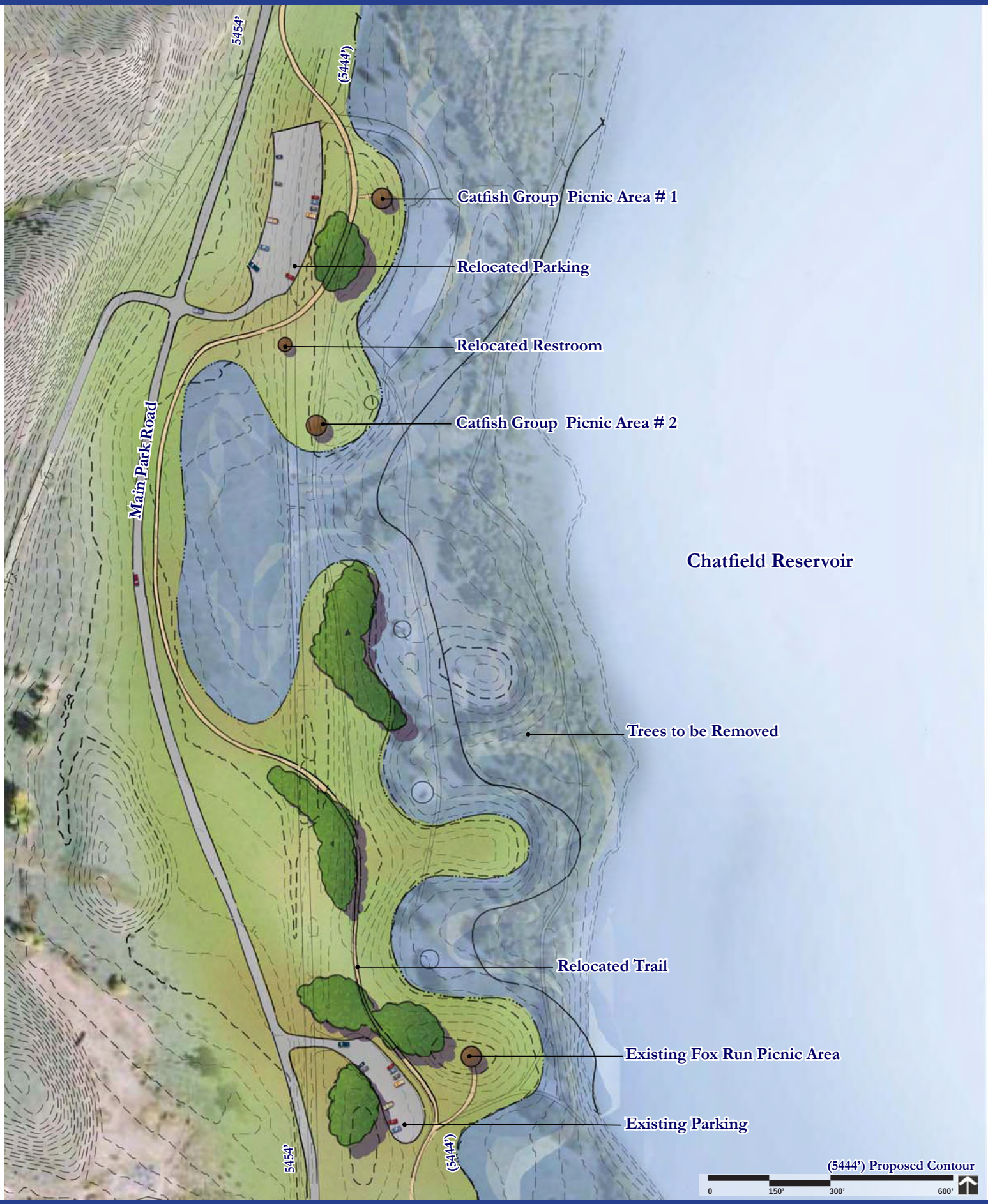
The majority of existing entrance roads, parking, shelters, restrooms, and utilities would be inundated at 5444'. New parking facilities would be developed closer to each of the group use areas, thereby enhancing access to these areas. These areas, which currently don't directly relate to the water, would have an improved setting, with each situated on an elevated site overlooking the reservoir. As noted on Map 3.4, the coves adjacent to the group use areas would be excavated, providing fill needed at other locations, but these excavations would also help to hold water during lower water conditions.

Catfish Flats Day Use Area

- Parking lot, restroom and picnic shelters will be inundated at 5444'.
- Due to the level of inundation, the picnic shelters will be located closer to the new parking lot.
- The new restroom will be in proximity to the shelters, and recreational facilities.

Fox Run Day Use Area

- Existing parking and picnic facilities are not inundated at the 5444; trails in the area are also above 5444'.
- Entrance to the parking lot will need to be reconstructed due to the new location of the main park road.



Map 3.4. Catfish Flats/Fox Run Modification Plan (5444' Elevation)

KINGFISHER/GRAVEL PONDS/PLATTE RIVER TRAILHEAD AREAS

A long section of the main park road would need to be raised and a new bridge constructed across the South Platte River. The bridge would remain in the same general location and would be designed to provide for pedestrian use. As discussed below, the reconstructed road would be located on a dike constructed to protect the gravel pond.

The concept for redeveloping this area is shown on Map 3.5.

Kingfisher Day Use Area

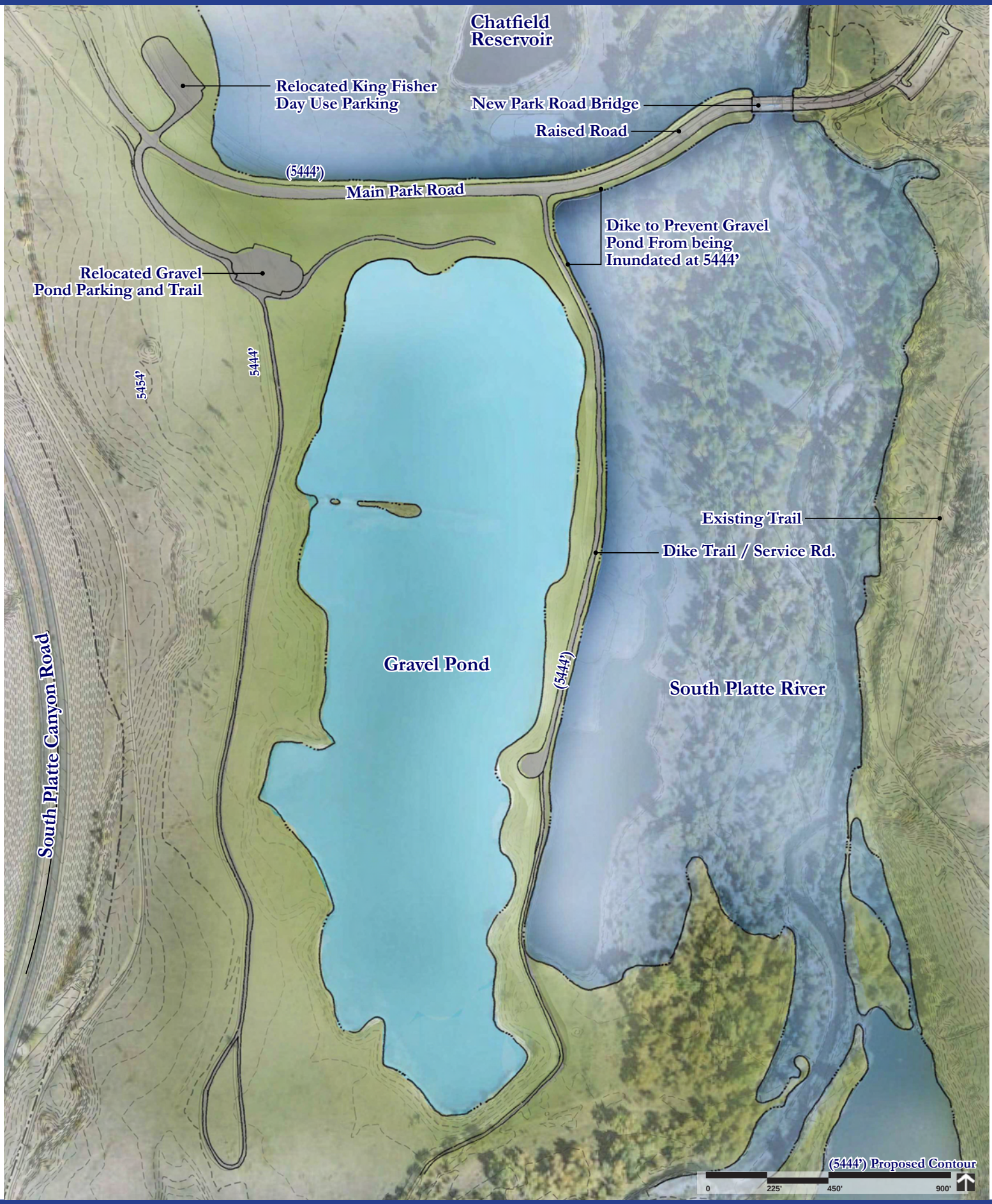
- Kingfisher area is entirely inundated at 5444'.
- A new parking area would be developed along the shoreline at a site west of its current location. The area would include a portable restroom and similar facilities to those that exist at the current site.
- Existing trail connections would be redeveloped above the high waterline to provide recreational opportunities.
- Borrow area configuration done to enhance the fishing opportunities and recreation experience.

Gravel Ponds

- A new parking lot will be developed west of the existing site and located above the 5444' elevation.
- Roads for emergency access only will be developed on the berms to the east and south of the gravel pond.
- The new permeable dike will be built to an elevation of 5457' based on the current bridge elevation above current high water level.
- Refer to Appendix 3 for more detailed specifics on the dike and the options considered.

Platte River Trailhead

- The restroom, parking lot, and trailhead are not affected by a water elevation of 5444'.
- The most significant impact to this facility is the inundation of the existing trails that lead to the Platte River. New concrete trails would be built to replace these trails.
- ADA pier accessibility.
- Grading of the new road in the area will have a minimal impact on existing facilities.



Map 3.5. King Fisher/Gravel Ponds/Platte River Trailhead Modification Plan (5444' Elevation)

MARINA AREA

There is significantly higher topography in the Marina area, which somewhat limits impacts to shoreline facilities. The relocation concept for this area is shown in Map 3.6.

Marina Point/South Ramp/Riverside Marina

- Marina Point facilities are significantly impacted at the proposed water elevation. The parking area, group day use area, volleyball, and horseshoe pits are all inundated.
- Significant earthwork in the form of earth fill needs to be accomplished to ensure future use in this area. The current facilities would be located on an elevated surface. This fill placement would include construction of new breakwaters similar to those that currently exist that would function at water elevation 5444'.
- The accessible fishing pier would be replaced in a similar location.

The following issues related to the marina operation were identified:

- The need to maintain the current anchoring scheme for the marina so the facility does not have to be routinely moved in and out during lake level fluctuations.
- The existing breakwater does not have winches and cannot be adjusted sufficiently to allow for the increased lake fluctuation levels.
- At the marina, the reservoir floor would be excavated down to 5412' to enable it to operate at extreme low water levels. This excavated material can be used to raise the breakwater elevations and provide fill for other locations. The marina would operate close to the existing location.
- The interface from the reservoir to the shore at the marina would be a rip rap embankment at 2:1 gradient. Due to the possibility of increased water level fluctuations, a sea wall was ruled out as an alternative due to the height it would need to be to function effectively. With a top of wall elevation of 5447' (3' freeboard), and a possible low water elevation of 5417', the 29-ft high visible structure was deemed too expensive and visually negative to be a reasonable option. This design would also cause access problems to the marina.
- The marina would be built on a flotation system designed to accommodate rise in water level that is above 5444' elevation.
- The parking areas, day use shelters, group use area and recreational areas associated with the South Ramp would also be inundated at 5444'. These areas would be rebuilt on fill areas in the same general location where they currently exist.
- Trails and walkways in the inundated area would be rebuilt.
- There is a distinct possibility that construction activities in the marina vicinity will result in a loss of revenue to the marina operator and state park. The window when construction could occur without significantly affecting marina operations is relatively short, extending from November through March. This is likely not enough time to complete the required reconstruction, particularly if adverse weather conditions are encountered. Potential economic effects resulting from this disruption are discussed in Chapter 4.

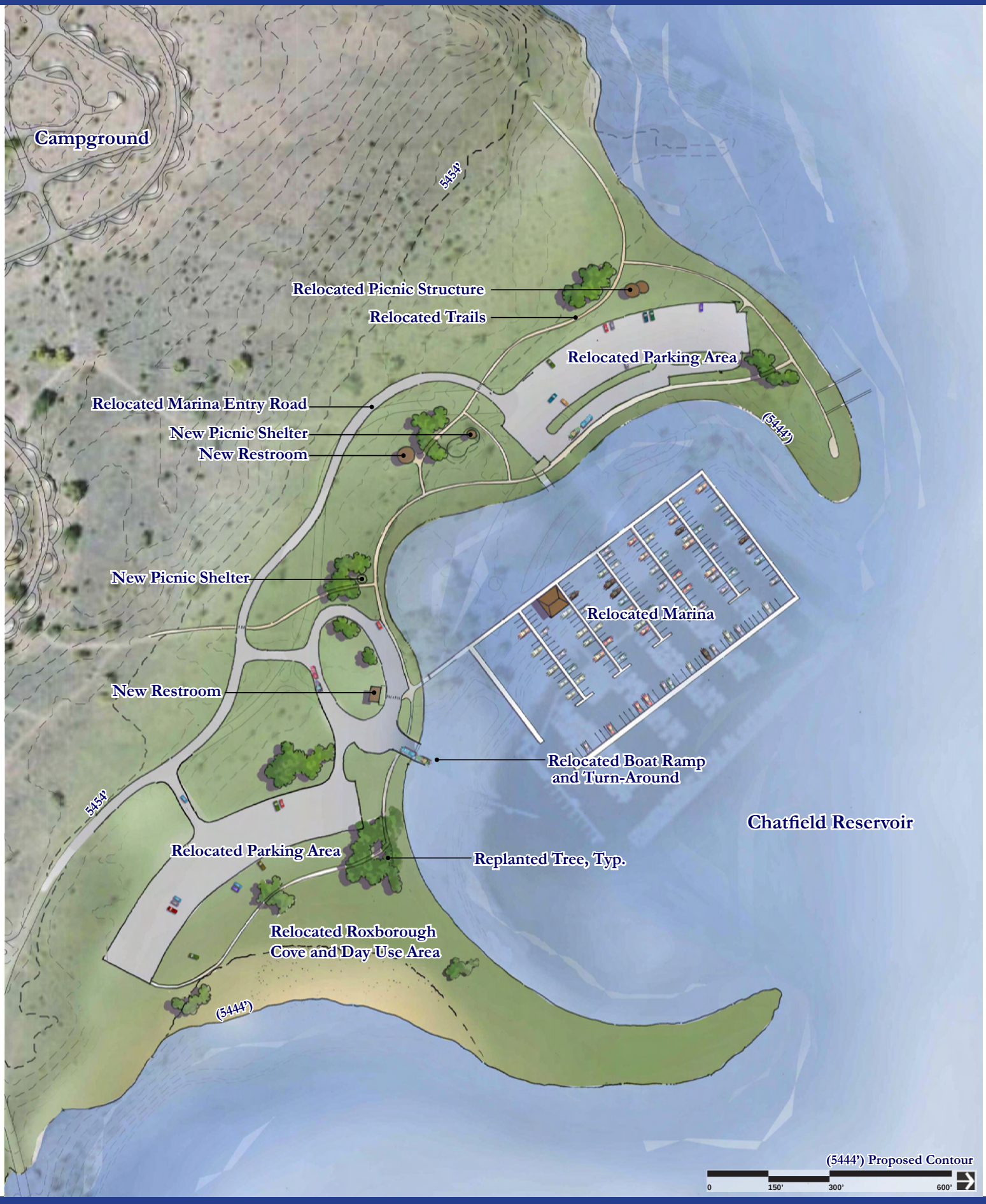
To maintain the existing anchoring scheme and allow the marina owner to maintain the historic levels of maintenance effort and cost related to the anchoring, new anchors will need to be constructed and installed and all existing winches will need to be replaced. When the average fluctuation of the lake is increased, the location of the existing anchors would not provide sufficient scope. The cost of moving existing anchors was evaluated, but proved to be more expensive than providing new anchors in the correct location.

These costs (rounded) are shown in Appendix 4, Attachment A. Appendix 4, Attachment B shows the scope ratio detail; Appendix 4, Attachment C shows the anchor weight calculations; and Appendix 4, Attachment D shows the cost comparison of moving vs. replacing the existing anchors.

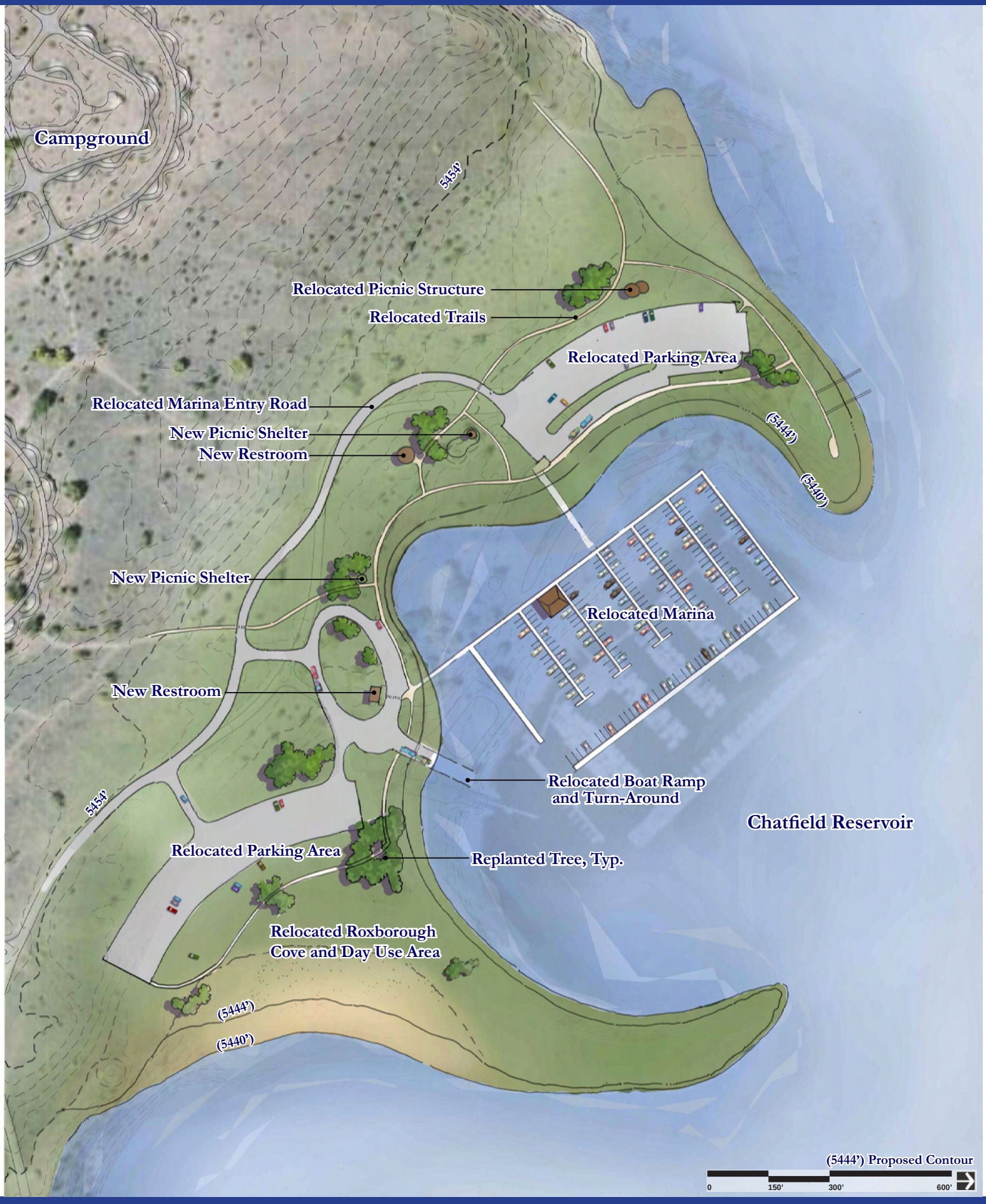
To allow the existing breakwater to be adjusted for the higher lake fluctuation levels, four flotation platforms with winches will be attached to the ends of the breakwater sections and new anchors placed.

Roxborough Day Use Area

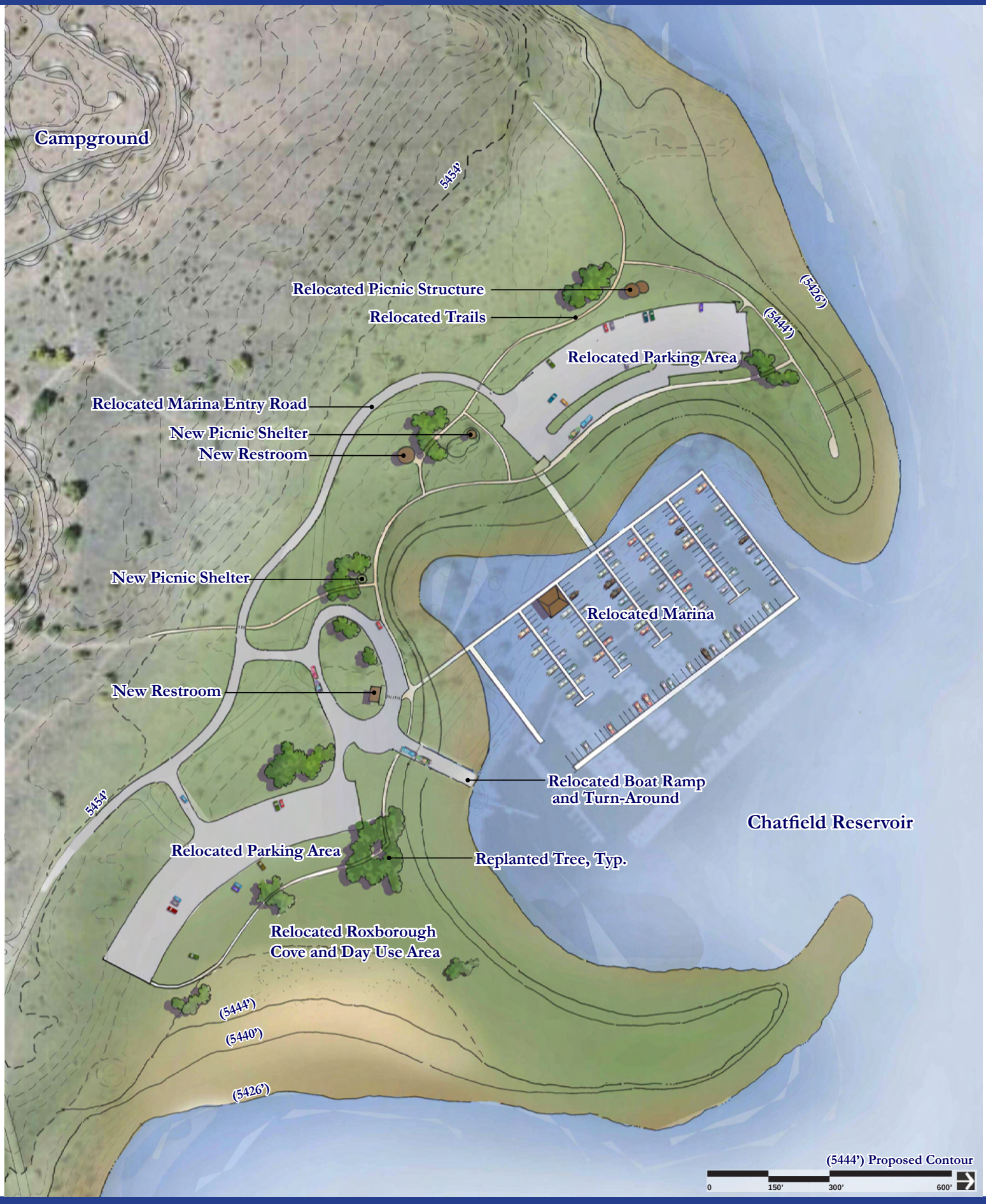
- This small yet popular day use area is entirely inundated at water elevation 5444'. It would be relocated to a new location close to it's existing one. Easy access to the shoreline, which it currently enjoys, would remain as the draw for this area.



Map 3.6.1. Marina Area
Modification Plan (5444' Elevation)



Map 3.6.2. Marina Area
Modification Plan (5440' Elevation)

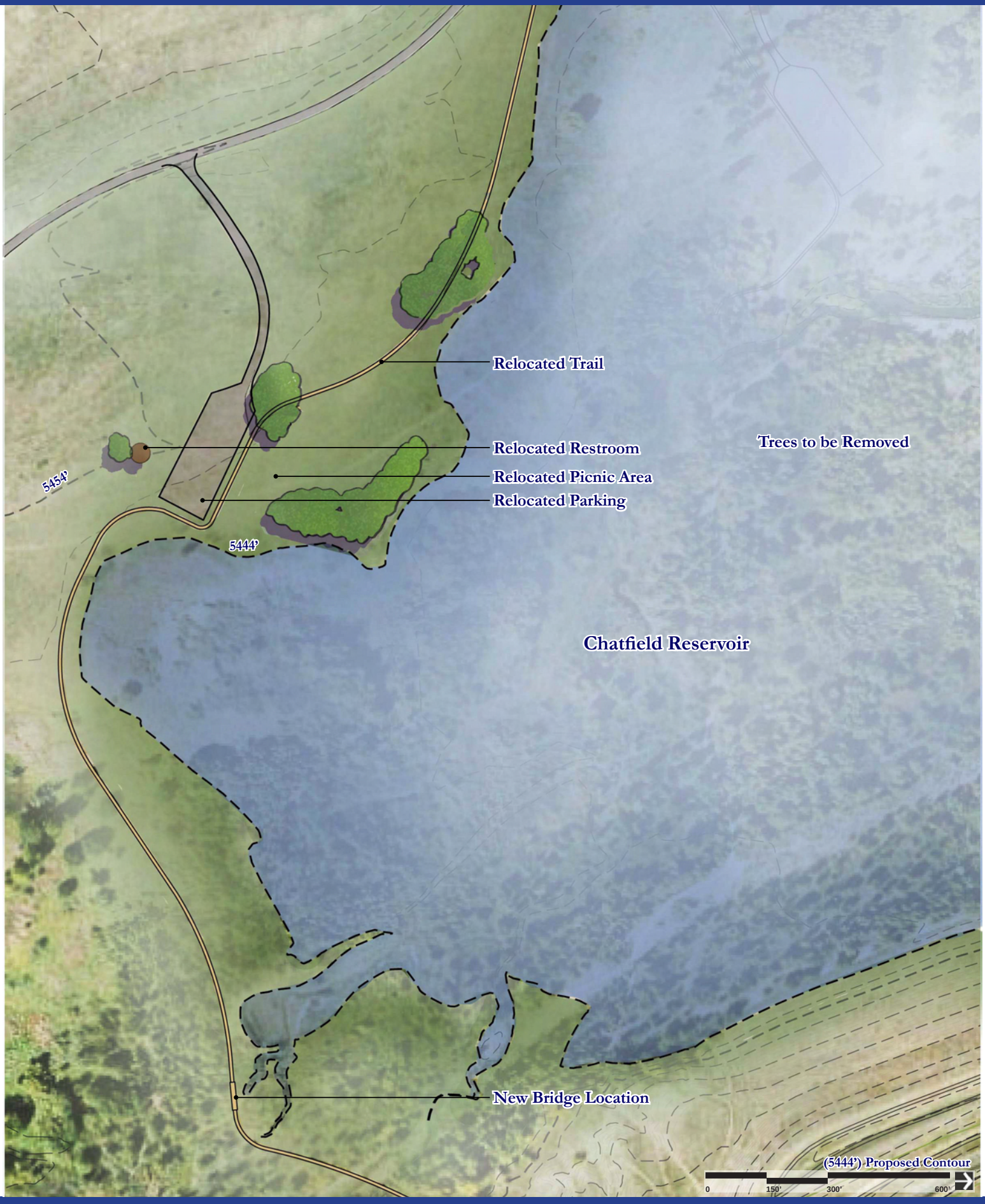


Map 3.6.3. Marina Area
Modification Plan (5426' Elevation)

PLUM CREEK AREA

- Plum Creek Day Use Area is entirely inundated at the proposed water elevation.
- The area would be relocated to the southern edge of the reservoir. The recreational facilities would be replaced at this location and a new restroom would be built.
- The Plum Creek trailhead would be relocated to this area and inundated trail segments replaced. A new trail bridge would be built to span Plum Creek.
- The existing sanitary sewer line will need to be relocated as it is below the 5444'.

The relocation concept for this area is shown in Map 3.7.



Map 3.7. Plum Creek Modification Plan (5444' Elevation)

Chapter 4. Economics

This chapter presents the costs associated with redevelopment of facilities affected by an increased water level. It includes a summary table showing overall costs. More detailed set of tables that itemize costs on an area-by-area basis are presented in Appendix 1.

In addition to development costs, it is likely that there would be some disruption to park visitation during the period when new recreation facilities are being constructed (refer to Appendix 7) and a corresponding diminishment of revenue derived from park visitation. Based on implementation of the recreation relocation plan and reservoir operations similar to those described in Chapter 2, a socio-economic study is being conducted in conjunction with this report in order to determine the overall effects of raising the water level to 5444' elevation.

OTHER COSTS

Chatfield Reservoir generates a substantial amount of revenue to Colorado State Parks, its concessions, and to the surrounding area. Some of this information is summarized in Table 4.1. on the following page. In 2003, revenue from fees alone was nearly $1.5 million. It is estimated that an additional $9.5 million was spent within the park on purchases, equipment rental, marina fees, and other items. Obviously, closure of the park or other interruptions to visitation during the construction of facilities included within the recreation relocation plan would have a significant economic impact. The magnitude of this impact will depend on construction timing, how it is phased, and other considerations that can't be defined with precision at this point in time. This underscores the need for development of an agreement between State Parks and reallocation project participants that accounts for potential revenue losses once a construction program has been defined.

Some important considerations are noted below:

- The most economical construction program is one that provides for a continuous construction period, rather than a phased program that extends construction over an extended period of time. An extended period would increase the costs estimated for completion of the recreation relocation plan. Again, the ability to implement a continuous program will depend on the timing of funding availability and other factors that can't be predicted at this time.
- A continuous construction program could reasonably complete the required work in 12-18 months. Some work could be completed on a year-round basis without disrupting recreational uses, while other construction should take place during the winter months or other periods when park visitation is low. For example, construction of new facilities at the North Boat Ramp and Marina areas will require closing these facilities during the construction period. For this reason, work on these facilities should be scheduled during the winter months. Conversely, some replacement facility sites, such as the swim beach, are located at a distance from the existing facilities. For this reason, the existing area could remain in use while the new area is being constructed.

For the reasons stated above, it will be necessary to estimate revenue loss at the time an actual construction program has been defined and to base payments for this loss on any actual revenue losses that are experienced rather than a potentially optimistic assumption on the level of disruption that will occur to park visitation.

Table 4.1. Chatfield State Park Economic Impacts

Year	Receipts Collected in the Park from Park Fees	Number of Visitors	Number of Vehicles	Expenditures per Vehicle Inside Park	Expenditures per Vehicle within 50-Mile Radius of Park	Total Park Income Generated per Year from All Sources
1984	457,489					
1985	499,942					
1986	538,596					
1987	672,957					
1988	675,124					
1989	701,552					
1990	533,303					
1991	754,780					
1992	714,120					
1993	725,143					
1994	781,747					
1995	677,261					
1996	850,032					
1997	937,113					
1998	1,037,278	1,329,689	511,419	$8,054,849	$19,485,063	$28,577,190
1999	1,022,284	1,096,203	421,616	$6,640,452	$16,063,569	$23,726,305
2000	1,180,506	1,187,947	456,903	$7,196,222	$17,408,004	$25,784,732
2001	1,237,922	1,373,600	528,308	$8,320,851	$20,128,534	$29,687,307
2002	1,333,170	1,448,895	557,267	$8,776,955	$21,231,782	$31,341,997
2003	1,464,447	1,566,580	602,531	$9,489,863	$22,956,431	$33,910,741
2004	1,378,338	1,496,264				
2005	1,534,028	1,582,811				
2006	1,701,080	1,476,930				
2007	2,010,592	1,505,500				
2008	2,072,051	1,675,197				

Source: Chatfield State Park Manager's Report and Recreation Market Assessment Study

Marina operations, in particular, are likely to experience some disruptions during the reconstruction period. Until a final design is completed and other contract details worked out, it is difficult to identify a precise construction schedule. Therefore, the reallocation agreement should provide for reimbursement to the park and to the marina operator for any revenue loss resulting from a disruption to normal operations. The actual amount of revenue loss would depend on when the disruption occurred and its duration.

Although some concern has been expressed about the potential for a multi-year revenue reduction if all or a part of the use season is lost, recent experience at Horsetooth Reservoir suggests this would not be the case. Reconstruction of facilities at Horsetooth Reservoir, which was completed in early fall of 2003, required maintaining low water levels for several years and reduced opportunities for boating and other uses. Both the park operator (Larimer County) and the private concession that operates the marina experienced a reduction in revenue during the construction period. These revenues were reimbursed by the Bureau of Reclamation as part of the reallocation agreement. However, once the reservoir resumed normal operations, park visitation quickly returned to normal. According to Larimer County Parks, the marina operator had a waiting list for slips prior to the construction effort and maintained a waiting list throughout that period. A rapid return to normal operations upon completion of construction is the most probable case at Chatfield State Park as well.

COST ESTIMATES

The Recreation Relocation Cost estimate is an opinion of probable costs for the construction and design of the plan elements and areas as shown on the Concept Plans dated January 2009. The following is a detailed description of the cost estimate and the assumptions utilized during cost estimation:

1. The estimate is a Class C estimate due to the conceptual level of planning and design that is in support of this estimate. At the preliminary stages of planning and design, it is very difficult to determine the complete scope of the project in detail; programming of the project is an approximation and is based on project meetings, existing site inventory and conditions, discussions and the designers and cost estimators professional experience. The cost estimate should be used for budgeting purposes only.
2. The conceptual plans and the cost estimate depict in-kind replacement of facilities.
3. The cost estimate is organized into the major site areas as shown on the concept plans. The individual items outlined in the cost estimate are not all shown on the concept plans; they are typical elements found in this type of project, as well as existing site elements inventoried at each site area.
4. The unit quantities are both take-offs of existing features from the concept plans as well as assumptions based on similar project experience. The assumptions are noted in the notes column of the cost estimate.
5. The unit costs are based on current cost estimate data collected from similar types of projects bid in the past few years as well as published cost data information for some project elements. The unit costs are, in our opinion, average construction costs for this type and quantity of project, based in 2008. The cost estimate does not include an escalation factor for development in the future. Escalation varies depending on current economic conditions and could vary between 3-6% per year from the date of the estimate to the start of construction.
6. The cost estimate does not include overall project development or overhead costs that may be accrued if the project is developed in multiple phases.
7. The following contingencies are utilized in the cost estimate:
   a. Contractors General Conditions. This is a percentage of total construction costs and includes the contractor's costs that are defined in the Division One of the Project specifications and are not generally included in the unit costs. The unit costs included in the estimate do include some Division One items including profit and overhead. General conditions include: Administrative Requirements (Permits, Bonds, Insurance, Scheduling, Submittals); Quality Requirements (Testing, Sampling); Temporary Facilities (Utilities, Trailers, Scaffolding, Tarpaulins, Barricades, Fences, Signs); Equipment Rental; Cleaning; and Commissioning (As-Builts, Punchlists, Training O&M Manuals). The percentage for General Conditions can range from 4 to 20%, depending on the size, location, complexity and other variables of the project and estimate. The percentage utilized in the Concept Plan Cost Estimate falls in the middle of this range.
   b. Contractor's Overhead and Profit. This is shown as a percentage of construction costs for the contractors business costs which include: Fixed Overhead Costs (Federal and state costs, social security tax, risk insurance, etc.) and Variable Overhead Costs (workers compensation, retirement programs, main office overhead). Profit is variable and depends on the scale of the project and schedule. Profit can include both the general contractors and the subcontractors.
   c. Federal Wage Rate Factor (Davis Bacon Wage rates). This is shown as a percentage of construction costs to cover the cost differences between standard wage rates and Davis Bacon wage rate schedules required on Federally funded projects. This is markup on wage rates only using the assumption that labor is generally 40% of a project costs. This factor is applied to that portion of the costs.
   d. Concept Level Design Contingency. This is a percentage of total construction costs and is included to cover the many details of the project that are not yet planned, designed, or known at this time. The plans are conceptual at this time; the cost estimate includes many assumptions and professional opinions. Design contingencies for a Class C estimate usually range from 15 to 30%.

8. The cost estimate reflects a percentage allowance for design services, which includes:
   a. Design Allowance. This is an allowance for the anticipated phases of design that will be required for this project. The allowance includes the following design phases:
      i. Pre-Design. This phase of design takes the project through the master plan and may include: project programming, design data collection, development of alternatives, value analysis of alternatives, pre-design summary document, design development and Class B cost estimate.
      ii. Special (Supplementary) Services. This can include: funding for archeology, constructability review, value analysis, final cost estimating, geotechnical surveys, historic structure reports, hazardous materials studies, visual simulation, visitor experience planning, geographic information system, graphics, topographical surveys, public meetings, etc.
      iii. Final Design. This is the final phase of Design, completing the design development started in pre-design through the completion of approved construction documents for bid negotiations.
   b. Construction Phase Services. This is a percentage of total construction costs, including Design Contingencies and General Conditions, and may include construction support services competed and/or contracted by the Owner, such as construction management, construction administration, materials and construction testing, surveying, compliance and monitoring services, etc.
   c. Owners Construction Phase Contingency. This is a percentage of total construction costs, including Design Contingencies and General Conditions, and is an allowance to cover potential changes to the final construction cost from unforeseen conditions, change orders and design changes.
9. Compliance and/or relocation costs are not included.
10. Tree removal costs are not included.
11. The costs included for utilities are assumptions only, as detailed utility plans were not available.
12. Grading costs assume excavation and embankment of material will be from the project site. Prices for hauling and excavation from outside of the project site are included as a separate line item in the cost estimate.

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Appendix 1. Cost Estimate Details

CHATFIELD RESERVOIR RECREATION MODIFICATIONPLAN **EDAW, Inc.**
CONCEPT PLAN COST ESTIMATE **November 10, 2009**

PLAN AREA	TOTAL COST
North Ramp	$636,228
Massey Draw	$357,851
Eagle Cove	$222,432
Deer Creek Day Use & Balloon Launch Area	$779,343
Swim Beach	$5,109,500
Jamison	$999,890
Catfish Flats	$902,609
Fox Run	$160,574
Kingfisher Area	$154,280
Gravel Ponds Area	$113,640
Platte River	$58,575
Marina Point	$1,292,796
South Ramp Including Marina	$4,730,557
Roxborough Cove	$213,949
Plum Creek	$249,943
Roads and Bridges	$6,570,963
Modification Plan Subtotal	**$22,553,130**

Cost Estimate Allowances		
Contractors General Conditions	12%	$2,706,376
Contractors Overhead and Profit	7%	$1,578,719
Federal Wage Rate Factor (6 % of 40% of subtotal)	6%	$541,275
Concept Design Contingency	25%	$5,638,282
Grand Total Allowances		$10,464,652
Modification Plan Total		**$33,017,782**

Design Services Allowance		
Design Allowance (Pre-Design, Special Services [Survey, Testing, etc.], Final Design)	18%	$5,943,201
Construction Phase Services	8%	$2,641,423
Owners Construction Phase Contingency	5%	$1,650,889
Grand Total Design Services Allowances		$10,235,512
Modification Plan Grand Total		**$43,253,294**

NORTH RAMP

ITEM	UNIT	UNIT QTY	UNIT COST	TOTAL COST	NOTES
DEMOLITION					
Clear and Grub	AC	3	$3,000.00	$9,000	Strip site and remove grasses, shrubs and trees
Remove Existing Asphalt Trail	SF	8,592	$1.00	$8,592	Asphalt trail to picnic shelters
Remove Existing Concrete trails	SF	0	$1.00	$0	
Remove Existing Asphalt Pavement	SF	60,345	$1.00	$60,345	Rotomill, stockpile and reuse as base course
Remove Existing Traffic Signs	Allow	1	$1,500.00	$1,500	Store and reinstall at future locations
Remove Existing Shade Structure	EA	4	$5,000.00	$20,000	
Remove and relocate Information Kiosk Signage	EA	2	$1,500.00	$3,000	
Remove & Relocate Existing Light Poles	EA	2	$3,500.00	$7,000	
CATEGORY SUBTOTAL				**$109,437**	
EARTHWORK					
Bulk Embankment	CY	5,592	$2.00	$11,184	
Excavation	CY	5,592	$2.00	$11,184	Includes excavation and short haul distance
Hauling	CY	1,617	$4.00	$6,468	Excavation and hauling for material above 5444'
Rock Removal	Allow	1	$12,000.00	$12,000	Allowance for unclassified rock removal
Topsoil - Strip , Stockpile and Spread	CY	2,868	$3.00	$8,604	Assumes 6" depth removal at surfaced areas, stockpile, and spread all new landscape areas
Fine Grading	SF	279,870	$0.05	$13,994	Assumes 120% of all paved and landscape areas
CATEGORY SUBTOTAL				**$63,434**	
ROADS AND PARKING					
Asphalt	TON	2,250	$60.00	$135,000	Includes new asphalt for regraded area; 6" depth
Striping	ALLOW	1	$5,000.00	$5,000	
Curb and gutter	LF	3,700	$10.00	$37,000	
CATEGORY SUBTOTAL				**$177,000**	
BOAT RAMPS					
Concrete	SF	16,000	$8.00	$128,000	Includes all launch lanes (2), plus extension for operations at 5417. 6-inch with stamped groove surface on ramp
Rip Rap Erosion Protection	Allow	1	$16,000.00	$16,000	At Boat ramp
Docks	Item	4	$1,200.00	$4,800	Assume reuse of docks. Salvage, store &relocate.
CATEGORY SUBTOTAL				**$148,800**	
ARCHITECTURE					
New Shade Structures	SF	640	$115.00	$73,600	4 shelters @ 160 SF each
CATEGORY SUBTOTAL				**$73,600**	
TRAILS					
Concrete Trails	SF	4,500	$4.00	$18,000	Assumes 8' wide path
Asphalt Trail	SF	0	$2.50	$0	Assumes 8' wide path
CATEGORY SUBTOTAL				**$18,000**	
FURNISHINGS					
Picnic Tables	EA	0	$200.00	$0	Store and relocate picnic tables under relocated shelters
Benches	Item	0	$100.00	$0	not affected
Water fountain	Item	0	$4,000.00	$0	2 attached per restroom building - Not affected
Dumpsters	Item	0	$795.00	$0	Store and reinstall at future locations
Trash Receptacles	Item	0	$50.00	$0	Store and reinstall at future locations
Bollards	Item	0	$160.00	$0	gate posts at launch ramps - store and relocate in existing location
Grills	Item	0	$75.00	$0	Store and reinstall at future locations
Regulatory Signs	Allow	0	$200.00	$0	Cost accounted for in demolition division
CATEGORY SUBTOTAL				**$0**	
UTILITIES					
Water Line	LF	400	$10.00	$4,000	1" diameter water distribution line. Assumed length for relocated hydrants
Sanitary Sewer Lateral Line	LF	0	$20.00	$0	4" diameter sewer lateral
Sanitary Sewer Manhole	EA	0	$3,700.00	$0	
Water Hydrants	EA	0	$4,000.00	$0	Frost Free Hydrant Includes connection to local piping and trenching costs

ITEM	UNIT	UNIT QTY	UNIT COST	TOTAL COST	NOTES
Lift Station	Item	0	$15,900.00	$0	not affected
Storm Water Inlets	EA	0	$3,710.00	$0	Storm Water inlet includes new piping and trenching
Storm Water Oil Separator Inlets	EA	0	$10,600.00	$0	Storm Water inlet for oil separation includes new piping and trenching
Storm Water Pipe	LF	0	$35.00	$0	Storm Water pipe - 12" diameter
CATEGORY SUBTOTAL				**$4,000**	
ELECTRICAL and TELECOMMUNICATIONS					
Electric Distribution Line	LF	200	$16.00	$3,200	Underground electric distribution in conduit. Allow for lighting and misc. electric.
Telephone Line	EA	0	$2,800.00	$0	Underground telephone wire in conduit
Transformers	Item	0	$0.00	$0	75 KVA
Light poles	Item	2	$1,000.00	$2,000	
CATEGORY SUBTOTAL				**$5,200**	
LANDSCAPE					
Seeding Dryland Grasses	SF	154,880	$0.10	$15,488	Drilled seeding disturbed areas.
Straw Mulch	SF	154,880	$0.05	$7,744	Crimped over seeded areas
Hydro Mulch	SF	0	$0.05	$0	Spray mulch over seeded areas
Deciduous Trees	EA	15	$375.00	$5,625	Allowance. 2.5 " Caliper
Evergreen Trees	EA	4	$350.00	$1,400	Allowance. 8' Average Height
Shrubs	EA	30	$25.00	$750	Allowance. 5 Gallon Shrubs
CATEGORY SUBTOTAL				**$31,007**	
IRRIGATION					
Point of Connection	EA	1	$2,000.00	$2,000	Connection to water main, vacuum breaker,
Spray Irrigation	SF	0	$1.00	$0	Large Radius Pop Up Heads
Bubbler Irrigation	Per Plant	50	$75.00	$3,750	Bubbler at Trees and Shrubs
CATEGORY SUBTOTAL				**$5,750**	
GRAND TOTAL (Refer to Summary for Estimate Markups)				**$636,228**	

MASSEY DRAW

ITEM	UNIT	UNIT QTY	UNIT COST	TOTAL COST	NOTES
DEMOLITION					
Clear and Grub	AC	2	$3,000.00	$6,000	Strip site and remove grasses, shrubs and trees
Remove Existing Asphalt Trail	SF	0	$1.00	$0	Asphalt trail to picnic shelters
Remove Existing Asphalt Pavement	SF	26,098	$1.00	$26,098	
Remove horse shoe boards and store	EA	4	$208.00	$832	
Remove volleyball court posts and store	EA	2	$208.00	$416	
CATEGORY SUBTOTAL				**$33,346**	
EARTHWORK					
Bulk Embankment	CY	2,230	$2.00	$4,460	
Excavation	CY	2,230	$2.00	$4,460	Includes excavation and short haul distances
Hauling	CY	1,617	$4.00	$6,468	Excavation and hauling for material above 5444'
Rock Removal	Allow	1	$6,000.00	$6,000	Allowance for unclassified rock removal
Topsoil - Strip , Stockpile and Spread	CY	2,269	$3.00	$6,807	Assumes 6" depth removal at surfaced areas, stockpile, and spread all new landscape areas
Fine Grading	SF	93,680	$0.05	$4,684	Assumes all paved and landscape areas
CATEGORY SUBTOTAL				**$32,879**	
PARKING AREA					
Asphalt	TON	975	$60.00	$58,500	Includes new asphalt for regraded area; 6" depth
Wheel Stops	Item	34	$20.00	$680	
CATEGORY SUBTOTAL				**$59,180**	
TRAILS					
Concrete Trails	SF	0	$3.50	$0	
Asphalt Trail	SF	3,180	$2.00	$6,360	Assumes 6' wide path
CATEGORY SUBTOTAL				**$6,360**	
ARCHITECTURE					
Restroom Building	SF	250	$125.00	$31,250	Relocate storage tanks and building above 5444'
CATEGORY SUBTOTAL				**$31,250**	
FURNITURE					
Picnic Tables	Item	8	$200.00	$1,600	Remove, store and relocate tables
Benches	Item	2	$100.00	$200	Remove, store and relocate 2 timber benches
Dumpsters	Item	0	$750.00	$0	not affected
Trash Receptacles	Item	3	$50.00	$150	Remove, store and relocate.
Grills	Item	0	$75.00	$0	not affected
Regulatory Signs	Item	0	$200.00	$0	not affected
Fencing	LF	0	$15.00	$0	not affected
CATEGORY SUBTOTAL				**$1,950**	
RECREATIONAL FACILITIES					
Beach Volleyball Court	Item	1	$10,000.00	$10,000	Includes court edge, new sand, reinstalled posts.
Horse Shoe Pits	Item	2	$2,500.00	$5,000	
CATEGORY SUBTOTAL				**$15,000**	
LANDSCAPE					
Seeding Dryland Grasses	SF	122,572	$0.10	$12,257	Allowance - 9 acres day use area. Drilled seeding
Straw Mulch	SF	122,572	$0.05	$6,129	Crimped over seeded areas
Hydro Mulch	SF	0	$0.05	$0	Spray mulch over seeded areas
Deciduous Trees	EA	200	$375.00	$75,000	Allowance. 2.5 " Caliper
Evergreen Trees	EA	100	$350.00	$35,000	Allowance. 8' Average Height
Shrubs	EA	250	$25.00	$6,250	Allowance. 5 Gallon Shrubs
CATEGORY SUBTOTAL				**$134,636**	
IRRIGATION					
Point of Connection	EA	1	$2,000.00	$2,000	Connection to water main, vacuum breaker,
Spray Irrigation	SF	0	$1.00	$0	Large Radius Pop Up Heads
Bubbler Irrigation	Per Plant	550	$75.00	$41,250	Bubbler at Trees and Shrubs
CATEGORY SUBTOTAL				**$43,250**	
GRAND TOTAL (Refer to Summary for Estimate Markups)				**$357,851**	

EAGLE COVE

ITEM	UNIT	UNIT QTY	UNIT COST	TOTAL COST	NOTES
DEMOLITION					
Clear and Grub	AC	4	$2,500.00	$10,000	Strip site and remove grasses and shrubs
Remove Existing Asphalt Trail	SF	11,792	$1.00	$11,792	Park asphalt trail
Remove and relocate post and cable barrier	LF	84	$10.00	$840	
Remove and relocate dumpster	EA	1	$100.00	$100	
CATEGORY SUBTOTAL				**$22,732**	
EARTHWORK					
Bulk Embankment	CY	850	$2.00	$1,700	
Excavation and Hauling	CY	850	$2.00	$1,700	Includes excavation and short haul distance
Hauling	CY	0	$4.00	$0	Excavation and hauling for material above 5444'
Rock Removal	Allow	1	$6,000.00	$6,000	Allowance for unclassified rock removal
Topsoil - Strip , Stockpile and Spread	CY	1,014	$3.00	$3,042	Assumes 6" depth removal at surfaced areas, stockpile, and spread all new landscape areas
Fine Grading	SF	54,802	$0.05	$2,740	Assumes all paved and landscape areas
CATEGORY SUBTOTAL				**$15,182**	
PARKING AREA AND TRAILS					
Asphalt Trail	SF	11,084	$2.00	$22,168	Assumes 6' wide path
Wheel Stops	ITEM	29	$20.00	$580	Relocated 6"x8"x8' CCA timber
Gravel	SF	21,100	$0.75	$15,825	Assume 8" depth base course = 40 SF/CY
CATEGORY SUBTOTAL				**$38,573**	
ARCHITECTURE					
Portable restroom	ITEM	1	$750.00	$750	Relocation to new location
CATEGORY SUBTOTAL				**$750**	
FURNITURE					
Dumpsters	ITEM	0	$750.00	$0	Cost accounted for in demolition division
Trash Receptacles	ITEM	1	$50.00	$50	Remove and relocate.
Regulatory Signs	EA	2	$200.00	$400	Traffic signs, warning signs, direction signs etc
Fencing	LF	84	$35.00	$2,940	
CATEGORY SUBTOTAL				**$3,390**	
UTILITIES					
Sanitary Sewer Lateral Line	LF	1,800	$20.00	$36,000	4" diameter sewer lateral, northwest of the area
				$36,000	
LANDSCAPE					
Seeding Dryland Grasses	SF	33,700	$0.10	$3,370	Drilled seeding
Straw Mulch	SF	33,700	$0.05	$1,685	Crimped over seeded areas
Hydro Mulch	SF	0	$0.05	$0	Spray mulch over seeded areas
Deciduous Trees	EA	150	$375.00	$56,250	2.5 " Caliper
Evergreen Trees	EA	50	$350.00	$17,500	8' Average Height
Shrubs	EA	100	$25.00	$2,500	5 Gallon Shrubs
CATEGORY SUBTOTAL				**$81,305**	
IRRIGATION					
Point of Connection	EA	1	$2,000.00	$2,000	Connection to water main, vacuum breaker, controller
Spray Irrigation	SF	0	$1.00	$0	Large Radius Pop Up Heads
Bubbler Irrigation	Per Plant	300	$75.00	$22,500	Bubbler at Trees and Shrubs
CATEGORY SUBTOTAL				**$24,500**	
GRAND TOTAL (Refer to Summary for Estimate Markups)				**$222,432**	

DEER CREEK DAY USE & BALLOON LAUNCH AREA

ITEM	UNIT	UNIT QTY	UNIT COST	TOTAL COST	NOTES
DEMOLITION					
Clear and Grub	AC	17	$2,500.00	$42,500	Strip site and remove grasses and shrubs
Remove Existing Concrete Trails	SF	17,720	$1.00	$17,720	
Remove Existing Asphalt Pavement	SF	34,732	$1.00	$34,732	
Remove Gravel Balloon Staging Road	SF	20,706	$0.20	$4,141	
Remove & Store Deer Creek footbridge	Allow	1	$5,200.00	$5,200	
Remove Existing Traffic Signs	Allow	1	$1,040.00	$1,040	Store and reinstall at future locations
Demolish & Remove Existing Restroom	Allow	1	$5,000.00	$5,000	
Remove and relocate Information Kiosk Signage	EA	1	$1,000.00	$1,000	
Remove and relocate wheel stops	EA	54	$10.00	$540	Remove, store and relocate
Remove and relocate Balloon Garden, sign & retaining wall	Allow	1	$31,200.00	$31,200	Remove and transplant to new Balloon Launch location
Remove and relocate Wind Sock	EA	1	$520.00	$520	
CATEGORY SUBTOTAL				**$143,593**	
EARTHWORK					
Bulk Embankment	CY	13,750	$2.00	$27,500	
Excavation	CY	13,750	$2.00	$27,500	Includes excavation and short haul distance
Hauling	CY	0	$4.00	$0	Excavation and hauling for material above 5444'
Rock Removal	Allow	1	$6,000.00	$6,000	Allowance for unclassified rock removal
Topsoil - Strip , Stockpile and Spread	CY	6,988	$3.00	$20,964	Assumes 6" depth removal at surfaced areas, stockpile, and spread all new landscape areas
Fine Grading	SF	377,344	$0.05	$19,622	Assumes all paved and landscape areas + 20%
CATEGORY SUBTOTAL				**$101,586**	
ROADS AND PARKING					
Asphalt	TON	1,200	$60.00	$72,000	
Striping	Allow	1	$1,000.00	$1,000	
CATEGORY SUBTOTAL				**$73,000**	
TRAILS					
Asphalt Trail	SF	0	$2.00	$0	Assumes 6' wide path
Concrete Trails	SF	16,048	$4.00	$64,192	Assumes 8' wide path
CATEGORY SUBTOTAL				**$64,192**	
STRUCTURES					
Restroom Building	SF	650	$225.00	$146,250	new restroom - four fixtures total
Information kiosk	EA	0	$1,500.00	$0	Cost to relocate accounted for in demolition division
CATEGORY SUBTOTAL				**$146,250**	
FURNISHINGS					
Picnic Tables	EA	8	$200.00	$1,600	Store and relocate picnic tables at future locations
Benches	Item	1	$100.00	$100	Store and relocate
Water fountain	Item	1	$520.00	$520	Provide replacement service at restroom
Dumpsters	Item	1	$750.00	$750	Store and reinstall at future location
Trash Receptacles	Item	1	$50.00	$50	Store and reinstall at future locations
Grills	Item	8	$75.00	$600	Store and reinstall at future locations
Regulatory Signs	Allow	0	$200.00	$0	Cost accounted for in demolition division
CATEGORY SUBTOTAL				**$3,620**	
UTILITIES					
Water Line	LF	500	$10.00	$5,000	1" diameter water distribution line
Sanitary Sewer Lateral Line	LF	500	$20.00	$10,000	4" diameter sewer lateral
Sanitary Sewer Manhole	EA	2	$3,640.00	$7,280	
Water Hydrants	EA	2	$1,560.00	$3,120	Frost Free Hydrant Includes connection to local piping and trenching costs
Lift Station	Item	0	$0.00	$0	not affected
Storm Water Inlets	EA	2	$3,640.00	$7,280	Storm Water inlet includes new piping and trenching
Storm Water Oil Separator Inlets	EA	1	$10,400.00	$10,400	Storm Water inlet for oil separation includes new piping and trenching
Storm Water Pipe	LF	500	$24.96	$12,480	Storm Water pipe - 12" diameter
CATEGORY SUBTOTAL				**$55,560**	

ITEM	UNIT	UNIT QTY	UNIT COST	TOTAL COST	NOTES
ELECTRICAL and TELECOMMUNICATIONS					
Electric Distribution Line	LF	500	$16.00	$8,000	Underground electric distribution in conduit
Telephone Line	EA	0	$2,800.00	$0	Underground telephone wire in conduit
Transformers	Item	0	$0.00	$0	75 KVA
Light poles	Item	0	$0.00	$0	Cost accounted for in demolition division
CATEGORY SUBTOTAL				**$8,000**	
LANDSCAPE					
Seeding Dryland Grasses	SF	669,500	$0.10	$69,628	Allowance. Drilled seeding disturbed areas.
Straw Mulch	SF	669,500	$0.05	$34,814	Crimped over seeded areas
Hydro Mulch	SF	0	$0.05	$0	Spray mulch over seeded areas
Deciduous Trees	EA	100	$375.00	$37,500	Allowance. 2.5 " Caliper
Evergreen Trees	EA	50	$350.00	$17,500	Allowance. 8' Average Height
Shrubs	EA	100	$26.00	$2,600	Allowance. 5 Gallon Shrubs
CATEGORY SUBTOTAL				**$162,042**	
IRRIGATION					
Point of Connection	EA	1	$2,000.00	$2,000	Connection to water main, vacuum breaker, controller
Spray Irrigation	SF	0	$1.00	$0	Large Radius Pop Up Heads
Bubbler Irrigation	Per Plant	250	$78.00	$19,500	Bubbler at Trees and Shrubs
CATEGORY SUBTOTAL				**$21,500**	
GRAND TOTAL (Refer to Summary for Estimate Markups)				**$779,343**	

SWIM BEACH

ITEM	UNIT	UNIT QTY	UNIT COST	TOTAL COST	NOTES
DEMOLITION					
Clear and Grub	AC	25	$2,500.00	$62,500	Strip site and remove grasses and shrubs
Remove Existing Concrete trails	SF	21,096	$1.00	$21,096	
Remove Existing Asphalt Pavement	SF	221,640	$1.00	$221,640	
Remove Existing Turf	SF	50,000	$0.10	$5,000	
Remove Existing Traffic Signs	Allow	1	$2,000.00	$2,000	Store and reinstall at future locations
Remove and Relocate Information Kiosks	EA	2	$1,000.00	$2,000	
Demolish Existing Buildings	Allow	3	$20,000.00	$60,000	
Remove and relocate wheel stops	EA	310	$20.00	$6,200	Remove, store and relocate
Remove and store Chain Mesh Fence	LF	929	$5.00	$4,645	
Remove and relocate post and rail fence	LF	44	$20.00	$880	
CATEGORY SUBTOTAL				**$385,961**	
EARTHWORK					
Bulk Embankment	CY	331,830	$2.00	$663,660	
Excavation	CY	331,830	$2.00	$663,660	Includes excavation and short haul distance
Hauling	CY	285,658	$4.00	$1,142,632	Excavation and hauling for material above 5444'
Rock Removal	Allow	1	$12,000.00	$12,000	Allowance for unclassified rock removal
Topsoil - Strip , Stockpile and Spread	CY	13,243	$3.00	$39,729	Assumes 6" depth removal at surfaced areas, stockpile, and spread all new landscape areas
Fine Grading	SF	943,188	$0.05	$47,159	Assumes all paved and landscape areas + 20%
CATEGORY SUBTOTAL				**$2,568,840**	
ROADS AND PARKING					
Asphalt	TON	6,000	$60.00	$360,000	
Striping	Allow	2	$5,000.00	$10,000	
CATEGORY SUBTOTAL				**$370,000**	
TRAILS					
Concrete Trails	SF	21,760	$4.00	$87,040	Assumes 8' wide path
CATEGORY SUBTOTAL				**$87,040**	
STRUCTURES					
Shower/Restroom Building	SF	1,600	$250.00	$400,000	
Concession Building	SF	650	$250.00	$162,500	
First Aid Station	SF	510	$250.00	$127,500	
Information kiosk	SF	2	$0.00	$0	Cost to relocate accounted for in demolition division
Concrete Plaza	SF	15,000	$5.00	$75,000	
CATEGORY SUBTOTAL				**$765,000**	
FURNISHINGS					
Picnic Tables	EA	12	$200.00	$2,400	Store and relocate picnic tables at future locations
Benches	Item	7	$100.00	$700	Store and relocate benchesat future locations
Water fountain	Item	0	$100.00	$0	Part of building cost
Dumpsters	Item	4	$750.00	$3,000	Store and reinstall at future locations
Trash Receptacles	Item	10	$50.00	$500	Store and reinstall at future locations
Bollards	Item	6	$150.00	$900	store and relocate in existing location
Grills	Item	8	$75.00	$600	Store and reinstall at future locations
Regulatory Signs	Allow	12	$200.00	$2,400	
Fencing - Chain Mesh	LF	929	$10.00	$9,290	
Fencing - Post and Rail	LF	44	$0.00	$0	Cost accounted for in demolition division
CATEGORY SUBTOTAL				**$19,790**	
RECREATIONAL FACILITIES					
Beach Sand	CY	19,240	$15.00	$288,600	Assumed 3' depth
CATEGORY SUBTOTAL				**$288,600**	
UTILITIES					
Water Line	LF	2,000	$10.00	$20,000	1" diameter water distribution line
Sanitary Sewer Lateral Line	LF	2,000	$20.00	$40,000	4" diameter sewer lateral
Sanitary Sewer Manhole	EA	4	$3,000.00	$12,000	48" dia. Manhole
Water Hydrants	EA	2	$1,500.00	$3,000	Frost Free Hydrant Includes connection to local piping and trenching costs
Lift Station	Item	2	$0.00	$0	not affected
Storm Water Inlets	EA	3	$3,500.00	$10,500	Storm Water inlet includes new piping and trenching
Storm Water Oil Separator Inlets	EA	2	$10,000.00	$20,000	Storm Water inlet for oil separation includes new piping and trenching
Storm Water Pipe	LF	1,000	$32.00	$32,000	Storm Water pipe - 12" diameter
Gas Main	LF	2,000	$30.00	$60,000	
CATEGORY SUBTOTAL				**$137,500**	

ITEM	UNIT	UNIT QTY	UNIT COST	TOTAL COST	NOTES
ELECTRICAL and TELECOMMUNICATIONS					
Electric Distribution Line	LF	2,000	$16.00	$32,000	Underground electric distribution in conduit
Telephone	EA	1	$2,800.00	$2,800	Underground telephone wire in conduit
Transformers	EA	1	$10,000.00	$10,000	75 KVA
Light poles	Item	0	$2,000.00	$0	Cost accounted for in demolition division
CATEGORY SUBTOTAL				**$44,800**	
LANDSCAPE					
Seeding Dryland Grasses	SF	708,127	$0.10	$70,813	Allowance. Drilled seeding disturbed areas.
Seeding Irrigated Turf Grasses	SF	65,000	$0.15	$9,750	Allowance. Drilled seeding disturbed areas.
Straw Mulch	SF	708,127	$0.05	$35,406	Crimped over seeded areas
Hydro Mulch	SF	330,000	$0.05	$16,500	Spray mulch over seeded areas
Deciduous Trees	EA	300	$375.00	$112,500	Allowance. 2.5 " Caliper
Evergreen Trees	EA	100	$350.00	$35,000	Allowance. 8' Average Height
Shrubs	EA	500	$25.00	$12,500	Allowance. 5 Gallon Shrubs
CATEGORY SUBTOTAL				**$292,469**	
IRRIGATION					
Point of Connection	EA	1	$2,000.00	$2,000	Connection to water main, vacuum breaker, controller
Spray Irrigation	SF	80,000	$1.00	$80,000	Large Radius Pop Up Heads
Bubbler Irrigation	Per Plant	900	$75.00	$67,500	Bubbler at Trees and Shrubs
CATEGORY SUBTOTAL				**$149,500**	
GRAND TOTAL (Refer to Summary for Estimate Markups)				**$5,109,500**	

JAMISON

ITEM	UNIT	UNIT QTY	UNIT COST	TOTAL COST	NOTES
DEMOLITION					
Clear and Grub	AC	16	$2,500.00	$40,000	Strip site and remove grasses and shrubs
Remove Existing Concrete trails	SF	16,576	$1.00	$16,576	See Overall Trails Cost Division at end of document
Remove Existing Asphalt Pavement	SF	43,431	$1.00	$43,431	
Remove Existing Traffic Signs	Allow	1	$1,000.00	$1,000	Store and reinstall at future locations
Remove and relocate wheel stops	EA	61	$10.00	$610	Remove, store and relocate
Demolish & Remove Existing Restroom	Allow	1	$5,000.00	$5,000	
CATEGORY SUBTOTAL				**$106,617**	
EARTHWORK					
Bulk Embankment	CY	1,000	$2.00	$2,000	Included in Swim Beach
Excavation	CY	1,000	$2.00	$2,000	Includes excavation and short haul distance
Hauling	CY	880	$4.00	$3,520	Excavation and hauling for material above 5444'
Rock Removal	Allow	1	$5,000.00	$5,000	Allowance for unclassified rock removal
Topsoil - Strip , Stockpile and Spread	CY	7,962	$3.00	$23,886	Assumes 6" depth removal at surfaced areas, stockpile, and spread all new landscape areas
Fine Grading	SF	483,987	$0.05	$24,199	Assumes all paved and landscape areas
CATEGORY SUBTOTAL				**$60,605**	
ROADS AND PARKING					
Asphalt	TON	1,376	$60.00	$82,560	new parking area and roadway; 6" depth
Striping	Allow	1	$1,000.00	$1,000	
CATEGORY SUBTOTAL				**$83,560**	
TRAILS					
Concrete Trails	SF	12,528	$3.00	$37,584	Assumes 8' wide trail
CATEGORY SUBTOTAL				**$37,584**	
STRUCTURES					
Restroom Building	SF	1,100	$250.00	$275,000	new restroom - four fixtures total
CATEGORY SUBTOTAL				**$275,000**	
FURNISHINGS					
Picnic Tables	EA	4	$200.00	$800	Store and relocate picnic tables under relocated shelters
Benches	Item	1	$100.00	$100	Store and relocate at future location
Water fountain	Item	2	$0.00	$0	2 attached per restroom building, part of Restroom cost.
Dumpsters	Item	1	$750.00	$750	Store and reinstall at future locations
Trash Receptacles	Item	1	$50.00	$50	Store and reinstall at future locations
Grills	Item	4	$75.00	$300	Store and reinstall at future locations
Regulatory Signs	Allow	0	$200.00	$0	Cost accounted for in demolition division
CATEGORY SUBTOTAL				**$2,000**	
UTILITIES					
Water Line	LF	500	$10.00	$5,000	1" diameter water distribution line
Sanitary Sewer Lateral Line	LF	500	$20.00	$10,000	4" diameter sewer lateral
Sanitary Sewer Manhole	EA	1	$3,500.00	$3,500	
Water Hydrants	EA	0	$1,500.00	$0	Frost Free Hydrant Includes connection to local piping and trenching costs
Lift Station	Item	0	$0.00	$0	not affected
Storm Water Inlets	EA	0	$3,500.00	$0	Storm Water inlet includes new piping and trenching
Storm Water Oil Separator Inlets	EA	0	$10,000.00	$0	Storm Water inlet for oil separation includes new piping and trenching
Storm Water Pipe	LF	0	$24.00	$0	Storm Water pipe - 12" diameter
Gas Main	LF	500	$30.00	$15,000	
CATEGORY SUBTOTAL				**$18,500**	
ELECTRICAL and TELECOMMUNICATIONS					
Electric Distribution Line	LF	500	$16.00	$8,000	Underground electric distribution in conduit
Telephone	EA	0	$2,800.00	$0	Underground telephone wire in conduit
Transformers	EA	0	$2,500.00	$0	75 KVA
Light poles	Item	0	$3,000.00	$0	Cost accounted for in demolition division
CATEGORY SUBTOTAL				**$8,000**	

ITEM	UNIT	UNIT QTY	UNIT COST	TOTAL COST	NOTES
LANDSCAPE					
Seeding Dryland Grasses	SF	440,157	$0.10	$44,016	Allowance. Drilled seeding disturbed areas.
Straw Mulch	SF	440,157	$0.05	$22,008	Crimped over seeded areas
Hydro Mulch	SF	0	$0.05	$0	Spray mulch over seeded areas
Deciduous Trees	EA	500	$375.00	$187,500	Allowance. 2.5 " Caliper
Evergreen Trees	EA	200	$350.00	$70,000	Allowance. 8' Average Height
Shrubs	EA	300	$25.00	$7,500	Allowance. 5 Gallon Shrubs
CATEGORY SUBTOTAL				**$331,024**	
IRRIGATION					
Point of Connection	EA	1	$2,000.00	$2,000	Connection to water main, vacuum breaker, controller
Spray Irrigation	SF	0	$1.00	$0	Large Radius Pop Up Heads
Bubbler Irrigation	Per Plant	1,000	$75.00	$75,000	Bubbler at Trees and Shrubs
CATEGORY SUBTOTAL				**$77,000**	
GRAND TOTAL (Refer to Summary for Estimate Markups)				**$999,890**	

CATFISH FLATS - GROUP AREA 1 & 2

ITEM	UNIT	UNIT QTY	UNIT COST	TOTAL COST	NOTES
DEMOLITION					
Clear and Grub	AC	35	$2,500.00	$87,500	Strip site and remove grasses and shrubs
Remove Existing Concrete trails	SF	15,072	$1.00	$15,072	
Remove Existing Asphalt Pavement	SF	61,361	$1.00	$61,361	
Remove and relocate wheel stops	EA	79	$10.00	$790	Remove, store and relocate
Demolish & Remove Existing Restroom	Allow	1	$5,000.00	$5,000	
Remove Existing shelter structures, store, demolish walls	EA	2	$10,000.00	$20,000	
CATEGORY SUBTOTAL				**$189,723**	
EARTHWORK					
Bulk Embankment	CY	7,513	$2.00	$15,026	
Excavation	CY	7,513	$2.00	$15,026	Includes excavation and short haul distance
Hauling	CY	1,000	$4.00	$4,000	Excavation and hauling for material above 5444'
Rock Removal	Allow	1	$10,000.00	$10,000	Allowance for unclassified rock removal
Topsoil - Strip , Stockpile and Spread	CY	6,476	$3.00	$19,428	Assumes 6" depth removal at surfaced areas, stockpile, and spread all new landscape areas
Fine Grading	SF	411,110	$0.05	$20,556	Assumes all paved and landscape areas
CATEGORY SUBTOTAL				**$84,036**	
ROADS AND PARKING					
Asphalt	TON	2,032	$60.00	$121,920	
Striping	Allow	1	$1,000.00	$1,000	
Curb and gutter	LF	0	$8.00	$0	
CATEGORY SUBTOTAL				**$122,920**	
TRAILS					
Concrete Trails	SF	21,264	$3.00	$63,792	
CATEGORY SUBTOTAL				**$63,792**	
STRUCTURES					
Restroom Building	SF	1,100	$250.00	$275,000	new restroom - four fixtures total
Group Picnic Area 1					75 person capacity
Walls	FF	135	$35.00	$4,725	135 LF, 56"h
Reinstall Group Shelters	EA	1	$7,500.00	$7,500	Dimensions of canopies approx:18'x21' ea.- 4
Day Use Shelter Concrete Pad	SF	0	$3.50	$0	Assume 1000 S.F. per Shelter
Gravel Pavement	SF	3,450	$0.75	$2,588	
Picnic Tables	Item	10	$100.00	$1,000	shelters
Grills	Item	1	$100.00	$100	Group grill - remove, store and reinstall at future
CATEGORY SUBTOTAL				**$290,913**	
Group Picnic Area 2					75 person capacity
Walls	FF	135	$35.00	$4,725	135 LF, 56" height
Group Shelters	EA	1	$7,500.00	$7,500	Dimensions of canopies approx. 18'x21' - 2 canopies
Gravel Pavement	SF	3,000	$0.75	$2,250	
Picnic Tables	Item	10	$100.00	$1,000	shelters
Grills	Item	1	$100.00	$100	Group grill - remove, store and reinstall at future
CATEGORY SUBTOTAL				**$15,575**	
FURNISHINGS					
Picnic Tables	EA	5	$200.00	$1,000	Store and relocate picnic tables under relocated shelters
Benches	Item	1	$100.00	$100	Store and relocate at future location
Water fountain	Item	2	$0.00	$0	2 attached per restroom building, part of Restroom
Dumpsters	Item	1	$750.00	$750	Store and reinstall at future locations
Trash Receptacles	Item	1	$50.00	$50	Store and reinstall at future locations
Grills	Item	0	$75.00	$0	Store and reinstall at future locations
Regulatory Signs	Allow	9	$0.00	$0	Cost accounted for in demolition division
CATEGORY SUBTOTAL				**$1,900**	

ITEM	UNIT	UNIT QTY	UNIT COST	TOTAL COST	NOTES
UTILITIES					
Water Line	LF	1,200	$8.00	$9,600	1" diameter water distribution line
Sanitary Sewer Lateral Line	LF	1,200	$20.00	$24,000	4" diameter sewer lateral
Sanitary Sewer Manhole	EA	0	$3,500.00	$0	
Water Hydrants	EA	0	$1,500.00	$0	Frost Free Hydrant Includes connection to local piping and trenching costs
Lift Station	Item	0	$0.00	$0	not affected
Storm Water Inlets	EA	0	$3,500.00	$0	Storm Water inlet includes new piping and trenching
Storm Water Oil Separator Inlets	EA	0	$10,000.00	$0	Storm Water inlet for oil separation includes new piping and trenching
Storm Water Pipe	LF	0	$24.00	$0	Storm Water pipe - 12" diameter
Gas Main	LF	1,200	$30.00	$36,000	
CATEGORY SUBTOTAL				**$33,600**	
ELECTRICAL and TELECOMMUNICATIONS					
Electric Distribution Line	LF	1,200	$16.00	$19,200	Underground electric distribution in conduit
Telephone	LF	0	$2,800.00	$0	Underground telephone wire in conduit
Transformers	EA	1	$2,500.00	$2,500	75 KVA
Light poles	Item	0	$3,000.00	$0	Cost accounted for in demolition division
CATEGORY SUBTOTAL				**$21,700**	
LANDSCAPE					
Seeding Dryland Grasses	SF	238,843	$0.10	$23,884	Allowance. Drilled seeding disturbed areas.
Straw Mulch	SF	238,843	$0.05	$11,942	Crimped over seeded areas
Hydro Mulch	SF	0	$0.05	$0	Spray mulch over seeded areas
Deciduous Trees	EA	50	$375.00	$18,750	Allowance. 2.5 " Caliper
Evergreen Trees	EA	25	$350.00	$8,750	Allowance. 8' Average Height
Shrubs	EA	75	$25.00	$1,875	Allowance. 5 Gallon Shrubs
CATEGORY SUBTOTAL				**$65,201**	
IRRIGATION					
Point of Connection	EA	1	$2,000.00	$2,000	Connection to water main, vacuum breaker, controller
Spray Irrigation	SF	0	$1.00	$0	Large Radius Pop Up Heads
Bubbler Irrigation	Per Plant	150	$75.00	$11,250	Bubbler at Trees and Shrubs
CATEGORY SUBTOTAL				**$13,250**	
GRAND TOTAL (Refer to Summary for Estimate Markups)				**$902,609**	

FOX RUN

ITEM	UNIT	UNIT QTY	UNIT COST	TOTAL COST	NOTES
DEMOLITION					
Clear and Grub	AC	5	$2,500.00	$12,500	Strip site and remove grasses and shrubs
Remove Gravel parking area	SF	0	$0.25	$0	
Remove Existing Concrete trails	SF	2,664	$1.00	$2,664	
Remove Existing shelter structures, store, demolish walls	Allow	1	$10,000.00	$10,000	
Remove horse show boards and store	EA	4	$200.00	$800	
Remove volleyball court posts and store	EA	2	$200.00	$400	
CATEGORY SUBTOTAL				**$26,364**	
EARTHWORK					
Bulk Embankment	CY	500	$2.00	$1,000	
Excavation	CY	500	$2.00	$1,000	Includes excavation and short haul distance
Hauling	CY	100	$4.00	$400	Excavation and hauling for material above 5444'
Rock Removal	Allow	1	$5,000.00	$5,000	Allowance for unclassified rock removal
Topsoil - Strip , Stockpile and Spread	CY	200	$3.00	$600	Assumes 6" depth removal at surfaced areas, stockpile, and spread all new landscape areas
Fine Grading	SF	5,250	$0.05	$263	Assumes all paved and landscape areas
CATEGORY SUBTOTAL				**$8,263**	
ROADS AND PARKING					
Asphalt	TON	0	$60.00	$0	
Striping	Allow	0	$1,000.00	$0	
CATEGORY SUBTOTAL				**$0**	
TRAILS					
Concrete Trails	SF	1,200	$3.00	$3,600	
CATEGORY SUBTOTAL				**$3,600**	
STRUCTURES					
Portable Restrooms	EA	1	$750.00	$750	Relocate to future location
Group Picnic Area					75 person capacity
Walls	FF	135	$35.00	$4,725	135 LF, 56"h
Reinstall Group Shelters	EA	1	$10,000.00	$10,000	Dimensions of canopies approx:18'x21' ea.- canopies
Gravel Pavement	SF	3,450	$0.75	$2,588	
Picnic Tables	Item	8	$100.00	$800	Store and relocate picnic tables under relocated shelters
Grills	Item	1	$100.00	$100	Group grill - remove, store and reinstall at future
CATEGORY SUBTOTAL				**$18,963**	
FURNISHINGS					
Dumpsters	Item	1	$750.00	$750	Store and reinstall at future locations
Trash Receptacles	Item	2	$50.00	$100	Store and reinstall at future locations
Regulatory Signs	Allow	5	$200.00	$1,000	Remove and relocate to future location
Fencing	LF	716	$10.00	$7,160	Remove and relocate to future location
CATEGORY SUBTOTAL				**$9,010**	
RECREATIONAL FACILITIES					
Beach Volleyball Court	Item	1	$10,000.00	$10,000	Includes court edge, new sand, reinstalled posts.
Horse Shoe Pits	Item	2	$2,500.00	$5,000	
CATEGORY SUBTOTAL				**$15,000**	
UTILITIES					
Water Line	LF	0	$8.00	$0	1" diameter water distribution line
Sanitary Sewer Lateral Line	LF	0	$20.00	$0	4" diameter sewer latera
Sanitary Sewer Manhole	EA	0	$3,500.00	$0	
Water Hydrants	EA	0	$1,500.00	$0	Frost Free Hydrant Includes connection to local piping and trenching costs
Lift Station	Item	0	$0.00	$0	not affected
Storm Water Inlets	EA	0	$3,500.00	$0	Storm Water inlet includes new piping and trenching
Storm Water Oil Separator Inlets	EA	0	$10,000.00	$0	Storm Water inlet for oil separation includes new piping and trenching
Storm Water Pipe	LF	0	$24.00	$0	Storm Water pipe - 12" diameter
Gas Main	LF	2,100	$30.00	$63,000	
CATEGORY SUBTOTAL				**$63,000**	

ITEM	UNIT	UNIT QTY	UNIT COST	TOTAL COST	NOTES
ELECTRICAL and TELECOMMUNICATIONS					
Electric Distribution Line	LF	0	$16.00	$0	Underground electric distribution in conduit
Telephone	EA	0	$2,800.00	$0	Underground telephone wire in conduit
Transformers	EA	0	$2,500.00	$0	75 KVA
Light poles	Item	0	$3,000.00	$0	Cost accounted for in demolition division
CATEGORY SUBTOTAL				**$0**	
LANDSCAPE					
Seeding Dryland Grasses	SF	5,000	$0.10	$500	Allowance. Drilled seeding disturbed areas.
Straw Mulch	SF	5,000	$0.05	$250	Crimped over seeded areas
Hydro Mulch	SF	0	$0.05	$0	Spray mulch over seeded areas
Deciduous Trees	EA	20	$375.00	$7,500	Allowance. 2.5 " Caliper
Evergreen Trees	EA	5	$350.00	$1,750	Allowance. 8' Average Height
Shrubs	EA	25	$25.00	$625	Allowance. 5 Gallon Shrubs
CATEGORY SUBTOTAL				**$10,625**	
IRRIGATION					
Point of Connection	EA	1	$2,000.00	$2,000	Connection to water main, vacuum breaker, controller
Spray Irrigation	SF	0	$1.00	$0	Large Radius Pop Up Heads
Bubbler Irrigation	Per Plant	50	$75.00	$3,750	Bubbler at Trees and Shrubs
CATEGORY SUBTOTAL				**$5,750**	
GRAND TOTAL (Refer to Summary for Estimate Markups)				**$160,574**	

KINGFISHER AREA

ITEM	UNIT	UNIT QTY	UNIT COST	TOTAL COST	NOTES
DEMOLITION					
Clear and Grub	AC	1	$2,500.00	$2,500	Strip site and remove grasses and shrubs
Remove Existing Concrete Trails	SF	24,000	$1.00	$24,000	Existing 8' wide trail on north side of roadway
Remove Existing Traffic Signs	Allow	1	$500.00	$500	Store and reinstall at future locations
Remove & Relocate Post and cable fencing	LF	375	$10.00	$3,750	
Remove and relocate wheel stops	EA	28	$10.00	$280	Remove existing and relocate to future location
CATEGORY SUBTOTAL				**$31,030**	
EARTHWORK					
Bulk Embankment	CY	2,590	$2.00	$5,180	
Excavation	CY	2,590	$2.00	$5,180	Includes excavation and short haul distance
Hauling	CY	5,185	$4.00	$20,740	Excavation and hauling for material above 5444'
Rock Removal	Allow	1	$2,500.00	$2,500	Allowance for unclassified rock removal
Topsoil - Strip , Stockpile and Spread	CY	1,100	$3.00	$3,300	Assumes 6" depth removal at surfaced areas, stockpile, and spread all new landscape areas
Fine Grading	SF	60,000	$0.05	$3,000	Assumes all paved and landscape areas
CATEGORY SUBTOTAL				**$39,900**	
ROADS AND PARKING					
Gravel	SF	60,000	$0.75	$45,000	
CATEGORY SUBTOTAL				**$45,000**	
FURNISHINGS					
Portable Restrooms	EA	1	$750.00	$750	Relocate to future location
Dumpsters	Item	1	$750.00	$750	Store and reinstall at future locations
Trash Receptacles	Item	1	$50.00	$50	Store and reinstall at future locations
Regulatory Signs	Allow	0	$200.00	$0	Cost accounted for in demolition division
CATEGORY SUBTOTAL				**$1,550**	
LANDSCAPE					
Seeding Dryland Grasses	SF	157,000	$0.10	$15,700	Allowance. Drilled seeding disturbed areas.
Straw Mulch	SF	157,000	$0.05	$7,850	Crimped over seeded areas
Hydro Mulch	SF	0	$0.05	$0	Spray mulch over seeded areas
Deciduous Trees	EA	10	$375.00	$3,750	Allowance. 2.5 " Caliper
Evergreen Trees	EA	10	$350.00	$3,500	Allowance. 8' Average Height
Shrubs	EA	25	$25.00	$625	Allowance. 5 Gallon Shrubs
CATEGORY SUBTOTAL				**$31,425**	
IRRIGATION					
Point of Connection	EA	1	$2,000.00	$2,000	Connection to water main, vacuum breaker, controller
Spray Irrigation	SF	0	$1.00	$0	Large Radius Pop Up Heads
Bubbler Irrigation	Per Plant	45	$75.00	$3,375	Bubbler at Trees and Shrubs
CATEGORY SUBTOTAL				**$5,375**	
GRAND TOTAL (Refer to Summary for Estimate Markups)				**$154,280**	

GRAVEL POND AREA

ITEM	UNIT	UNIT QTY	UNIT COST	TOTAL COST	NOTES
DEMOLITION					
Clear and Grub	AC	8	$2,500.00	$20,000	Strip site and remove grasses and shrubs
Remove Existing Regulatory Signs	Allow	1	$200.00	$200	Remove, store and reinstall at future locations
Remove and relocate wheel stops	EA	38	$10.00	$380	Remove, store and relocate
Remove & Relocate Post and cable fencing	LF	596	$10.00	$5,960	
CATEGORY SUBTOTAL				**$26,540**	
EARTHWORK					
Bulk Embankment	CY	200	$2.00	$400	
Excavation	CY	200	$2.00	$400	Includes excavation and short haul distance
Hauling	CY	100	$4.00	$400	Excavation and hauling for material above 5444'
Rock Removal	Allow	1	$1,000.00	$1,000	Allowance for unclassified rock removal
Topsoil - Strip , Stockpile and Spread	CY	300	$3.00	$900	Assumes 6" depth removal at surfaced areas, stockpile, and spread all new landscape areas
Fine Grading	SF	52,500	$0.05	$2,625	Assumes all paved and landscape areas
CATEGORY SUBTOTAL				**$5,725**	
ROADS AND PARKING					
Gravel	SF	40,500	$0.75	$30,375	Includes new asphalt for regraded area
Bridge	EA	0	$0.00	$0	Included in Sear Brown Cost Estimate
CATEGORY SUBTOTAL				**$30,375**	
STRUCTURES					
Portable Restrooms	EA	0	$750.00	$0	Relocate to future location
CATEGORY SUBTOTAL				**$0**	
TRAILS					
Concrete Trails	SF	16,000	$3.00	$48,000	8' wide trail
CATEGORY SUBTOTAL				**$48,000**	
FURNISHINGS					
Picnic Tables	EA	4	$100.00	$400	shelters
Dumpsters	Item	1	$750.00	$750	Store and reinstall at future locations
Trash Receptacles	Item	1	$50.00	$50	Store and reinstall at future locations
Grills	Item	0	$75.00	$0	Store and reinstall at future locations
Regulatory Signs	Allow	0	$200.00	$0	Cost accounted for in demolition division
CATEGORY SUBTOTAL				**$1,200**	
UTILITIES					
Water Line	LF	2,600	$10.00	$26,000	1" diameter water distribution line
				$26,000	
LANDSCAPE					
Seeding Dryland Grasses	SF	12,000	$0.10	$1,200	Allowance. Drilled seeding disturbed areas.
Straw Mulch	SF	12,000	$0.05	$600	Crimped over seeded areas
Hydro Mulch	SF	0	$0.05	$0	Spray mulch over seeded areas
Deciduous Trees	EA	0	$375.00	$0	Allowance. 2.5 " Caliper
Evergreen Trees	EA	0	$350.00	$0	Allowance. 8' Average Height
Shrubs	EA	0	$25.00	$0	Allowance. 5 Gallon Shrubs
CATEGORY SUBTOTAL				**$1,800**	
IRRIGATION					
Point of Connection	EA	0	$2,000.00	$0	Connection to water main, vacuum breaker, controller
Spray Irrigation	SF	0	$1.00	$0	Large Radius Pop Up Heads
Bubbler Irrigation	Per Plant	0	$75.00	$0	Bubbler at Trees and Shrubs
CATEGORY SUBTOTAL				**$0**	
GRAND TOTAL (Refer to Summary for Estimate Markups)				**$113,640**	

PLATTE RIVER

ITEM	UNIT	UNIT QTY	UNIT COST	TOTAL COST	NOTES
DEMOLITION					
Clear and Grub	AC	1	$2,500.00	$2,500	Strip site and remove grasses and shrubs
Remove Existing Concrete Trails	SF	2,120	$1.00	$2,120	
Remove Existing Asphalt Pavement	SF	18,622	$1.00	$18,622	
CATEGORY SUBTOTAL				**$23,242**	
EARTHWORK					
Bulk Embankment	CY	150	$2.00	$300	
Excavation	CY	150	$2.00	$300	Includes excavation and short haul distance
Hauling	CY	100	$4.00	$400	Excavation and hauling for material above 5444'
Rock Removal	Allow	1	$1,000.00	$1,000	Allowance for unclassified rock removal
Topsoil - Strip , Stockpile and Spread	CY	1,000	$3.00	$3,000	Assumes 6" depth removal at surfaced areas, stockpile, and spread all new landscape areas
Fine Grading	SF	28,160	$0.05	$1,408	Assumes all paved and landscape areas
CATEGORY SUBTOTAL				**$6,408**	
TRAILS					
Concrete Trails	SF	2,120	$3.00	$6,360	
CATEGORY SUBTOTAL				**$6,360**	
LANDSCAPE					
Seeding Dryland Grasses	SF	15,525	$0.10	$1,553	Allowance. Drilled seeding disturbed areas.
Straw Mulch	SF	15,252	$0.05	$763	Crimped over seeded areas
Hydro Mulch	SF	0	$0.05	$0	Spray mulch over seeded areas
Deciduous Trees	EA	20	$375.00	$7,500	Allowance. 2.5 " Caliper
Evergreen Trees	EA	10	$350.00	$3,500	Allowance. 8' Average Height
Shrubs	EA	50	$25.00	$1,250	Allowance. 5 Gallon Shrubs
CATEGORY SUBTOTAL				**$14,565**	
IRRIGATION					
Point of Connection	EA	1	$2,000.00	$2,000	Connection to water main, vacuum breaker, controller
Spray Irrigation	SF	0	$1.00	$0	Large Radius Pop Up Heads
Bubbler Irrigation	Per Plant	80	$75.00	$6,000	Bubbler at Trees and Shrubs
CATEGORY SUBTOTAL				**$8,000**	
GRAND TOTAL (Refer to Summary for Estimate Markups)				**$58,575**	

ROXBOROUGH COVE

ITEM	UNIT	UNIT QTY	UNIT COST	TOTAL COST	NOTES
DEMOLITION					
Clear and Grub	AC	6	$2,500.00	$15,000	Strip site and remove grasses and shrubs
Remove Existing Vault Restroom	Allow	1	$2,500.00	$2,500	
Remove Existing Regulatory Signs	Allow	1	$200.00	$200	Remove, store and reinstall at future locations
CATEGORY SUBTOTAL				**$17,700**	
EARTHWORK					
Bulk Embankment	CY	500	$2.00	$1,000	(Fill = 500 CY, Cut = 500 CY)
Rock Removal	Allow	1	$1,000.00	$1,000	Allowance for unclassified rock removal
Excavation	CY	500	$3.00	$1,500	Includes excavation and 1 mile haul to construction site
Topsoil - Strip , Stockpile and Spread	CY	1,000	$4.00	$4,000	Assumes 6" depth removal at surfaced areas, stockpile, and spread all new landscape areas
Fine Grading	SF	50,000	$0.05	$2,500	Assumes all paved and landscape areas
CATEGORY SUBTOTAL				**$10,000**	
PARKING AREA					
Gravel	SF	0	$0.75	$0	not affected
CATEGORY SUBTOTAL				**$0**	
ARCHITECTURE					
Vault Restroom Building	SF	250	$125.00	$31,250	Relocated
CATEGORY SUBTOTAL				**$31,250**	
FURNISHINGS					
Picnic Tables	EA	5	$100.00	$500	Store and relocate picnic tables under relocated shelters
Trash Receptacles	Item	3	$50.00	$150	Store and reinstall at future locations
Grills	Item	5	$75.00	$375	Store and reinstall at future locations
Regulatory Signs	Allow	0	$200.00	$0	Cost accounted for in demolition division
CATEGORY SUBTOTAL				**$1,025**	
RECREATIONAL FACILITIES					
Beach Sand	CY	7,333	$15.00	$109,995	Assumed depth of 3'
CATEGORY SUBTOTAL				**$109,995**	
LANDSCAPE					
Seeding Dryland Grasses	SF	129,026	$0.10	$12,903	Allowance. Drilled seeding disturbed areas.
Straw Mulch	SF	129,026	$0.05	$6,451	Crimped over seeded areas
Hydro Mulch	SF	0	$0.05	$0	Spray mulch over seeded areas
Deciduous Trees	EA	25	$375.00	$9,375	Allowance. 2.5 " Caliper
Evergreen Trees	EA	15	$350.00	$5,250	Allowance. 8' Average Height
Shrubs	EA	50	$25.00	$1,250	Allowance. 5 Gallon Shrubs
CATEGORY SUBTOTAL				**$35,229**	
IRRIGATION					
Point of Connection	EA	1	$2,000.00	$2,000	Connection to water main, vacuum breaker, controller
Spray Irrigation	SF	0	$1.00	$0	Large Radius Pop Up Heads
Bubbler Irrigation	Per Plant	90	$75.00	$6,750	Bubbler at Trees and Shrubs
CATEGORY SUBTOTAL				**$8,750**	
GRAND TOTAL (Refer to Summary for Estimate Markups)				**$213,949**	

MARINA POINT

ITEM	UNIT	UNIT QTY	UNIT COST	TOTAL COST	NOTES
DEMOLITION					
Clear and Grub	AC	16	$2,500.00	$40,000	Strip site and remove grasses and shrubs
Remove Existing shelter structures, store	Allow	2	$20,000.00	$40,000	6 canopies
Remove Existing Concrete Plaza at group area	SF	5,088	$1.00	$5,088	
Remove Existing Concrete trails	SF	31,864	$1.00	$31,864	Includes Riverside South Ramp trails
Remove Existing Asphalt Pavement	SF	152,383	$1.00	$152,383	
Remove Existing Regulatory Signs	Allow	1	$200.00	$200	
Remove and relocate wheel stops	EA	200	$10.00	$2,000	Remove, store and relocate
Remove & relocate timber fencing	LF	138	$10.00	$1,380	
Demolish & Remove Existing Restroom	Allow	1	$5,000.00	$5,000	
Remove & Relocate Existing Light Poles	EA	3	$3,000.00	$9,000	
Remove horse show boards and store	EA	4	$200.00	$800	
Remove volleyball court posts and store	EA	2	$200.00	$400	
CATEGORY SUBTOTAL				**$288,115**	
EARTHWORK					
Bulk Embankment	CY	1,000	$2.00	$2,000	Earthwork numbers included in South Ramp
Excavation	CY	1,000	$2.00	$2,000	Embankment numbers included in South Ramp
Hauling	CY	1,000	$4.00	$4,000	Excavation and hauling for material above 5444'
Rock Removal	Allow	1	$1,000.00	$1,000	Allowance for unclassified rock removal
Topsoil - Strip , Stockpile and Spread	CY	8,128	$3.00	$24,384	Assumes 6" depth removal at surfaced areas, stockpile, and spread all new landscape areas
Fine Grading	SF	440,000	$0.05	$22,000	Assumes all paved and landscape areas
CATEGORY SUBTOTAL				**$55,384**	
ROADS AND PARKING					
Asphalt	TON	5,353	$60.00	$321,180	Includes new asphalt for regraded area
Striping	Allow	1	$7,500.00	$7,500	
CATEGORY SUBTOTAL				**$328,680**	
TRAILS					
Concrete Trails	SF	28,320	$3.00	$84,960	Assumes 8' wide path
CATEGORY SUBTOTAL				**$84,960**	
STRUCTURES					
Group Picnic - Marina Point					125 person capacity
Walls	FF	630	$35.00	$22,050	135 LF, 56"h
Reinstall Group Shelters	Allow	1	$20,000.00	$20,000	Dimensions of canopies approx:18'x21' ea.- 6
Day Use Shelter Concrete Pad	SF	1,000	$3.50	$3,500	Assume 1000 S.F. per Shelter
Concrete Pavement	SF	5,088	$3.00	$15,264	
Picnic Tables	Item	10	$100.00	$1,000	Store and relocate picnic tables under relocated shelters
Electric hookups	Allow	1	$500.00	$500	Provision of conduit and outlets, not connection to power
Grills	Item	1	$100.00	$100	Group grill - remove, store and reinstall at future
CATEGORY SUBTOTAL				**$62,414**	
ADA Fishing Pier	Allow	1	$5,000.00	$5,000	Remove and relocate to future location
Portable Restrooms	EA	1	$750.00	$750	Relocate to future location
Restroom Building	SF	1,100	$250.00	$275,000	
CATEGORY SUBTOTAL				**$280,750**	
FURNISHINGS					
Picnic Tables	EA	0	$100.00	$0	Qty allowed for in group structure
Benches	Item	1	$100.00	$100	Store and reinstall at future locations
Water fountain	Item	2	$0.00	$0	2 attached per restroom building - in restroom cost
Dumpsters	Item	2	$750.00	$1,500	Store and reinstall at future locations
Trash Receptacles	Item	1	$50.00	$50	Store and reinstall at future locations
Regulatory Signs	Allow	0	$200.00	$0	Cost accounted for in demolition division
CATEGORY SUBTOTAL				**$1,650**	
RECREATIONAL FACILITIES					
Beach Volleyball Court	Item	1	$10,000.00	$10,000	Includes court edge, new sand, reinstalled posts.

ITEM	UNIT	UNIT QTY	UNIT COST	TOTAL COST	NOTES
Horse Shoe Pits	Item	2	$2,500.00	$5,000	
CATEGORY SUBTOTAL				**$15,000**	
UTILITIES					
Water Line	LF	0	$10.00	$0	1" diameter water distribution line
Sanitary Sewer Lateral Line	LF	0	$20.00	$0	4" diameter sewer lateral
Sanitary Sewer Manhole	EA	0	$3,500.00	$0	
Water Hydrants	EA	0	$1,500.00	$0	Frost Free Hydrant Includes connection to local piping and trenching costs
Lift Station	Item	0	$0.00	$0	not affected
Storm Water Inlets	EA	1	$3,500.00	$3,500	Storm Water inlet includes new piping and trenching
Storm Water Oil Separator Inlets	EA	1	$10,000.00	$10,000	Storm Water inlet for oil separation includes new piping and trenching
Storm Water Pipe	LF	500	$24.00	$12,000	Storm Water pipe - 12" diameter
CATEGORY SUBTOTAL				**$25,500**	
ELECTRICAL and TELECOMMUNICATIONS					
Electric Distribution Line	LF	0	$16.00	$0	Underground electric distribution in conduit
Telephone	LF	250	$16.00	$4,000	Underground telephone wire in conduit
Transformers	EA	0	$2,800.00	$0	75 KVA
Outlet Waterproofing	EA	2	$1,000.00	$2,000	in picnic shleters
Light poles	Item	0	$3,000.00	$0	Cost accounted for in demolition division
CATEGORY SUBTOTAL				**$6,000**	
LANDSCAPE					
Seeding Dryland Grasses	SF	440,620	$0.10	$44,062	Allowance. Drilled seeding disturbed areas.
Straw Mulch	SF	440,620	$0.05	$22,031	Crimped over seeded areas
Hydro Mulch	SF	0	$0.05	$0	Spray mulch over seeded areas
Deciduous Trees	EA	100	$375.00	$37,500	Allowance. 2.5 " Caliper
Evergreen Trees	EA	50	$350.00	$17,500	Allowance. 8' Average Height
Shrubs	EA	100	$25.00	$2,500	Allowance. 5 Gallon Shrubs
CATEGORY SUBTOTAL				**$123,593**	
IRRIGATION					
Point of Connection	EA	1	$2,000.00	$2,000	Connection to water main, vacuum breaker, controller
Spray Irrigation	SF	0	$1.00	$0	Large Radius Pop Up Heads
Bubbler Irrigation	Per Plant	250	$75.00	$18,750	Bubbler at Trees and Shrubs
CATEGORY SUBTOTAL				**$20,750**	
GRAND TOTAL (Refer to Summary for Estimate Markups)				**$1,292,796**	

SOUTH RAMP including RIVERSIDE MARINA

ITEM	UNIT	UNIT QTY	UNIT COST	TOTAL COST	NOTES
DEMOLITION					
Clear and Grub	AC	15	$2,500.00	$37,500	Strip site and remove grasses and shrubs
Remove Existing Concrete trails	SF	0	$1.00	$0	Cost accounted for in Marina Point costs.
Remove Existing Asphalt Pavement	SF	168,610	$1.00	$168,610	
Remove Existing Traffic Signs	Allow	1	$1,000.00	$1,000	Store and reinstall at future locations
Demolish Existing Buildings	Allow	1	$15,000.00	$15,000	
Remove & Relocate Existing Shade Structure	EA	3	$10,000.00	$30,000	
Remove and relocate wheel stops	EA	124	$10.00	$1,240	Remove, store and relocate
Remove and relocate Information Kiosk Signage	EA	1	$1,000.00	$1,000	
Remove & Relocate Existing Light Poles	EA	1	$3,000.00	$3,000	
Remove horse show boards and store	EA	4	$200.00	$800	
Remove volleyball court posts and store	EA	2	$200.00	$400	
CATEGORY SUBTOTAL				**$258,550**	
EARTHWORK					
Marina excavation	allow	1	$550,000.00	$550,000	Allows for excavating reservoir floor to operate at 5717, relocation of marina docks and shoring during construction and relocating at present location after construction.
Bulk Embankment	CY	143,818	$2.00	$287,636	
Excavation	CY	287,636	$2.00	$575,272	Includes excavation and short haul distance
Hauling	CY	224,372	$4.00	$897,488	Excavation and hauling for material above 5444'
Rock Removal	Allow	1	$25,000.00	$25,000	Allowance for unclassified rock removal
Topsoil - Strip , Stockpile and Spread	CY	8,128	$3.00	$24,384	Assumes 6" depth removal at surfaced areas, stockpile, and spread all new landscape areas
Fine Grading	SF	500,000	$0.05	$25,000	Assumes all paved and landscape areas
CATEGORY SUBTOTAL				**$2,384,780**	
ROADS AND PARKING					
Asphalt	TON	6,562	$60.00	$393,720	Includes new asphalt for regraded area
Striping	Allow	1	$7,500.00	$7,500	
CATEGORY SUBTOTAL				**$401,220**	
BOAT RAMPS & MARINA					
Concrete	SF	5,000	$8.00	$40,000	Includes all launch lanes (2)
Rip Rap Erosion	SY	10,000	$50.00	$500,000	Boat Ramp and breakwaters up to 5432'
Upgrade of marina cables and winches	Allow	1	$310,000.00	$310,000	See Aramark memo for cost breakdown
CATEGORY SUBTOTAL				**$850,000**	
TRAILS					
Concrete Trails	SF	16,000	$3.00	$48,000	Assumes 8' wide path
CATEGORY SUBTOTAL				**$48,000**	
STRUCTURES					
Group Picnic - Riverside					125 person capacity
Walls	FF	630	$35.00	$22,050	135 LF, 56"h
Reinstall Group Shelters	Allow	1	$10,000.00	$10,000	Dimensions of canopies approx:18'x21' ea.- 6 canopies
Day Use Shelter Concrete Pad	SF	1,000	$3.50	$3,500	Assume 1000 S.F. per Shelter
Concrete Pavement	SF	5,088	$3.00	$15,264	
Picnic Tables	Item	10	$100.00	$1,000	Store and relocate picnic tables under relocated shelters
Electric hookups	Allow	1	$500.00	$500	Provision of conduit and outlets, not connection to power
Grills	Item	1	$100.00	$100	Group grill - remove, store and reinstall at future
CATEGORY SUBTOTAL				**$52,414**	
Restroom and Shower Building	SF	1,600	$250.00	$400,000	Replace restroom and shower building
Day Use Shelter	EA	3	$0.00	$0	Cost to relocate accounted for in demolition division
Information kiosk	EA	1	$0.00	$0	Cost to relocate accounted for in demolition division
CATEGORY SUBTOTAL				**$400,000**	

ITEM	UNIT	UNIT QTY	UNIT COST	TOTAL COST	NOTES
FURNISHINGS					
Picnic Tables	EA	3	$200.00	$600	Store and relocate picnic tables under relocated shelters
Benches	Item	4	$100.00	$400	Store and relocate at future location
Water fountain	Item	1	$0.00	$0	Attached per restroom building - in restroom cost
Dumpsters	Item	4	$750.00	$3,000	Store and reinstall at future locations
Trash Receptacles	Item	4	$50.00	$200	Store and reinstall at future locations
Bollards	Item	4	$150.00	$600	gate posts at launch ramps - store and relocate in existing location
Grills	Item	3	$75.00	$225	Store and reinstall at future locations
Regulatory Signs	Allow	0	$200.00	$0	Cost accounted for in demolition division
CATEGORY SUBTOTAL				**$5,025**	
RECREATIONAL FACILITIES					
Beach Volleyball Court	Item	1	$10,000.00	$10,000	Includes court edge, new sand, reinstalled posts.
Horse Shoe Pits	Item	2	$2,500.00	$5,000	
CATEGORY SUBTOTAL				**$15,000**	
UTILITIES					
Water Line	LF	1,000	$10.00	$10,000	1" diameter water distribution line
Sanitary Sewer Lateral Line	LF	3,300	$20.00	$66,000	4" diameter sewer lateral
Sanitary Sewer Manhole	EA	4	$3,500.00	$14,000	
Water Hydrants	EA	3	$1,500.00	$4,500	Frost Free Hydrant Includes connection to local piping and trenching costs
Lift Station	Item	0	$0.00	$0	not affected
Storm Water Inlets	EA	2	$3,500.00	$7,000	Storm Water inlet includes new piping and trenching
Storm Water Oil Separator Inlets	EA	2	$10,000.00	$20,000	Storm Water inlet for oil separation includes new piping and trenching
Storm Water Pipe	LF	1,000	$32.00	$32,000	Storm Water pipe - 12" diameter
CATEGORY SUBTOTAL				**$153,500**	
ELECTRICAL and TELECOMMUNICATIONS					
Electric Distribution Line	LF	1,800	$16.00	$28,800	Underground electric distribution in conduit
Telephone	LF	1	$2,800.00	$2,800	Underground telephone wire in conduit
Transformers	EA	1	$2,500.00	$2,500	75 KVA
Outlet Waterproofing	EA	2	$1,000.00	$2,000	in picnic shleters
Light poles	Item	0	$3,000.00	$0	Cost accounted for in demolition division
CATEGORY SUBTOTAL				**$36,100**	
LANDSCAPE					
Seeding Dryland Grasses	SF	430,620	$0.10	$43,062	Allowance. Drilled seeding disturbed areas.
Straw Mulch	SF	430,620	$0.05	$21,531	Crimped over seeded areas
Hydro Mulch	SF	0	$0.05	$0	Spray mulch over seeded areas
Deciduous Trees	EA	75	$375.00	$28,125	Allowance. 2.5 " Caliper
Evergreen Trees	EA	25	$350.00	$8,750	Allowance. 8' Average Height
Shrubs	EA	100	$25.00	$2,500	Allowance. 5 Gallon Shrubs
CATEGORY SUBTOTAL				**$103,968**	
IRRIGATION					
Point of Connection	EA	1	$2,000.00	$2,000	Connection to water main, vacuum breaker, controller
Spray Irrigation	SF	5,000	$1.00	$5,000	Large Radius Pop Up Heads
Bubbler Irrigation	Per Plant	200	$75.00	$15,000	Bubbler at Trees and Shrubs
CATEGORY SUBTOTAL				**$22,000**	
GRAND TOTAL (Refer to Summary for Estimate Markups)				**$4,730,557**	

PLUM CREEK PICNIC AREA

ITEM	UNIT	UNIT QTY	UNIT COST	TOTAL COST	NOTES
DEMOLITION					
Clear and Grub	AC	13	$2,500.00	$32,500	Strip site and remove grasses and shrubs
Remove Gravel parking area	SF	31,000	$0.15	$4,650	
Remove Existing Concrete trails	SF	18,000	$1.00	$18,000	
Demolish & Remove Existing Restroom	Allow	1	$5,000.00	$5,000	
Remove Existing Regulatory Signs	Allow	1	$200.00	$200	Remove, store and reinstall at future locations
Remove & Relocate Post and cable fencing	LF	697	$10.00	$6,970	
Remove volleyball court posts and store	EA	2	$200.00	$400	
CATEGORY SUBTOTAL				**$67,720**	
EARTHWORK					
Bulk Embankment	CY	500	$2.00	$1,000	
Excavation	CY	500	$2.00	$1,000	Includes excavation and short haul distance
Hauling	CY	100	$4.00	$400	Excavation and hauling for material above 5444'
Rock Removal	Allow	1	$1,000.00	$1,000	Allowance for unclassified rock removal
Topsoil - Strip , Stockpile and Spread	CY	185	$4.00	$740	Assumes 6" depth removal at surfaced areas, stockpile, and spread all new landscape areas
Fine Grading	SF	10,000	$0.05	$500	Assumes all paved and landscape areas
CATEGORY SUBTOTAL				**$4,640**	
ROADS AND PARKING					
Gravel Parking	SF	31,000	$0.80	$24,800	
Gravel entry road	SF	14,400	$0.80	$11,520	
CATEGORY SUBTOTAL				**$36,320**	
TRAILS					
Concrete Trails	SF	15,600	$3.00	$46,800	
CATEGORY SUBTOTAL				**$46,800**	
STRUCTURES					
Vault Restroom	SF	485	$125.00	$60,625	
CATEGORY SUBTOTAL				**$60,625**	
FURNISHINGS					
Picnic Tables	EA	11	$200.00	$2,200	shelters
Benches	Item	1	$100.00	$100	Store and relocate at future location
Dumpsters	Item	1	$750.00	$750	Store and reinstall at future locations
Grills	Item	5	$75.00	$375	Store and reinstall at future locations
Regulatory Signs	Allow	0	$200.00	$0	Cost accounted for in demolition division
CATEGORY SUBTOTAL				**$3,425**	
UTILITIES					
Sanitary Sewer Lateral Line	LF	5,500	$20.00	$110,000	4" diameter sewer lateral
Sanitary Sewer Manhole	EA	6	$3,500.00	$21,000	
CATEGORY SUBTOTAL				**$131,000**	
RECREATIONAL FACILITIES					
Beach Volleyball Court	Item	1	$5,000.00	$5,000	Includes new sand, reinstalled posts.
CATEGORY SUBTOTAL				**$5,000**	
LANDSCAPE					
Seeding Dryland Grasses	SF	5,250	$0.10	$525	Allowance. Drilled seeding disturbed areas.
Straw Mulch	SF	5,250	$0.05	$263	Crimped over seeded areas
Hydro Mulch	SF	0	$0.05	$0	Spray mulch over seeded areas
Deciduous Trees	EA	25	$375.00	$9,375	Allowance. 2.5 " Caliper
Evergreen Trees	EA	15	$350.00	$5,250	Allowance. 8' Average Height
Shrubs	EA	50	$25.00	$1,250	Allowance. 5 Gallon Shrubs
CATEGORY SUBTOTAL				**$16,663**	
IRRIGATION					
Point of Connection	EA	1	$2,000.00	$2,000	Connection to water main, vacuum breaker, controller
Spray Irrigation	SF	0	$1.00	$0	Large Radius Pop Up Heads
Bubbler Irrigation	Per Plant	90	$75.00	$6,750	Bubbler at Trees and Shrubs
CATEGORY SUBTOTAL				**$8,750**	
GRAND TOTAL (Refer to Summary for Estimate Markups)				**$249,943**	

CHATFIELD STATE PARK REALLOCATION STUDY **January 2, 2009**
CONCEPT PLAN COST ESTIMATE
Colorado State Parks
Project Cost Estimate for Design and Construction

Item and Description	Quantity	Unit	Unit Cost	Total
1 – Remove Structure - Deer Creek Box Culverts including embankment, headwalls, and guardrails	1	EA	$25,000.00	$25,000
2 – Remove Pipe – Existing Drainage Culverts (5 assumed)	1	LS	$5,000.00	$5,000
3 – Remove Asphalt Mat from existing roadway	48,300	SY	$4.50	$217,350
4 – Remove Existing Bridges at Platte River and southeast corner of existing reservoir	2	EA	$15,000.00	$30,000
5 – Obliterate Old Roadway (Assumes approx.14,000 LF @ 24” depth)	37,600	CY	$7.00	$263,200
6 - Unclassified Excavation (complete in place)	60,000	CY	$7.50	$450,000
7 - Rock Fill for soft area stabilization (12" depth over 20% of roadway length)	10,000	CY	$17.00	$170,000
8 - Topsoil Removal and Replacement	12,341	CY	$6.00	$74,046
9 - Seeding (native) (assumes 20' on both sides of new roadway and restoration of approx. 11,500 LF of existing roadway)	25	AC	$900.00	$22,500
10 - Mulching (weed free hay)	25	AC	$600.00	$15,000
11 - Aggregate Base Course (CL 6) (12" depth)	16,709	CY	$18.00	$300,762
12 - Hot Bituminous Pavement (6" depth)	16,930	TN	$60.00	$1,015,800
13 - Riprap (assumes 15' coverage at each drainage structure)	230	CY	$48.00	$11,040
14 - 24 Inch Diameter RCP	595	LF	$60.00	$35,700
15 - 36 Inch Diameter RCP	70	LF	$72.00	$5,040
16 - 48 Inch Diameter RCP	85	LF	$125.00	$10,625
17 - 24 Inch Reinforced Concrete End Section	17	EA	$600.00	$10,200
18 - 36 Inch Reinforced Concrete End Section	2	EA	$850.00	$1,700
19 - 48 Inch Reinforced Concrete End Section	5	EA	$1,000.00	$5,000
20 - Double 10' x 6' Concrete Box Culvert (complete in place)	4	EA	$80,000.00	$320,000
21 – 42’ x 72.5’ Bridge at Deer Creek Crossing	1	LS	$168,000.00	$168,000
22 - 42’ x 200’ Bridge at Platte River Crossing	1	LS	$504,000.00	$504,000
23 - Delineators	100	EA	$20.00	$2,000
24 - Miscellaneous Signage	1	LS	$10,000.00	$10,000
25 - Erosion Control	1	LS	$50,000.00	$50,000
26 - Environmental Mitigation (wetland/habitat restoration)	1	LS	$30,000.00	$30,000
27 - Pavement Marking Paint	500	GAL	$38.00	$19,000
28 - AECOM Water Dike Earthwork Cost (See memo)	1	EA	$2,800,000.00	$2,800,000
Subtotal				**$6,570,963**

Note: Existing quantities reduced 30% to account for new dike roadway. Unit costs have been adjusted.

Appendix 2. Road Alignment Study

Chatfield Reservoir Roadway Analysis

Sear-Brown was retained by The Colorado Water Conservation Board to work with EDAW on the Recreational Mitigation Study and more specifically to analyze the cost impacts of re-aligning the main circulation roadway within Chatfield Park. The study consisted of several meetings, discussions and on-site visits with the design team to determine a feasible route and extent of needed improvements. The product for this study was intended to be a conceptual level design for the roadway re-alignment along with an opinion of probable construction cost. The remainder of this study will outline the criteria utilized, investigations made, route selection results, conceptual level design documents, and opinion of probable construction cost.

Criteria

1. The re-alignment study is based on raising the current normal water level in the reservoir approximately 12 feet to an elevation of approximately 5444 per the base map drawings created by EDAW. All design information is based on the topography depicted in EDAW base maps.
2. State Parks desires to have a 2 foot freeboard above the normal water level that will keep the roadway operational which results in a minimum roadway elevation of 5446.
3. Roadway sections are to be similar to the current Chatfield Park conditions with the addition of a 4 foot wide paved shoulder for bicycle use per the request of State Parks.
4. Geometric design criteria is based on design guidelines contained in "A Policy on Geometric Design of Highways and Streets by American Association of State Highway and Transportation Officials (AASHTO).
   a) The roadway is assumed to be classified as a special purpose road – recreational road.
   b) A roadway section consisting of two 11 foot wide paved lanes, 4 foot wide paved shoulders and a 10 foot wide vegetated clear zone on each side has been utilized.
   c) The re-aligned roadway functions as a primary access roadway to the park facilities and a 40 mph design speed is appropriate. Portions of the existing roadway are posted at 35 mph currently.
   d) For conceptual design purposes it is assumed that horizontal curves will be superelevated to a maximum rate of 0.06 which established a minimum horizontal radius for conceptual design purposes of approximately 521 feet.

5. There will be two bridge structures over the length of the re-aligned roadway. One at Deer Creek and the other at the Platte River. Each structure is sized to accommodate the roadway section plus guardrails and an 8 foot wide pedestrian/bike trail for a total structure width of approximately 42 feet wide.
6. Drainage structures have been located and sized based on a site review of existing upstream culverts along highway 121 (Wadsworth/Canyon Road) and a review of the existing topography along the proposed roadway alignment.

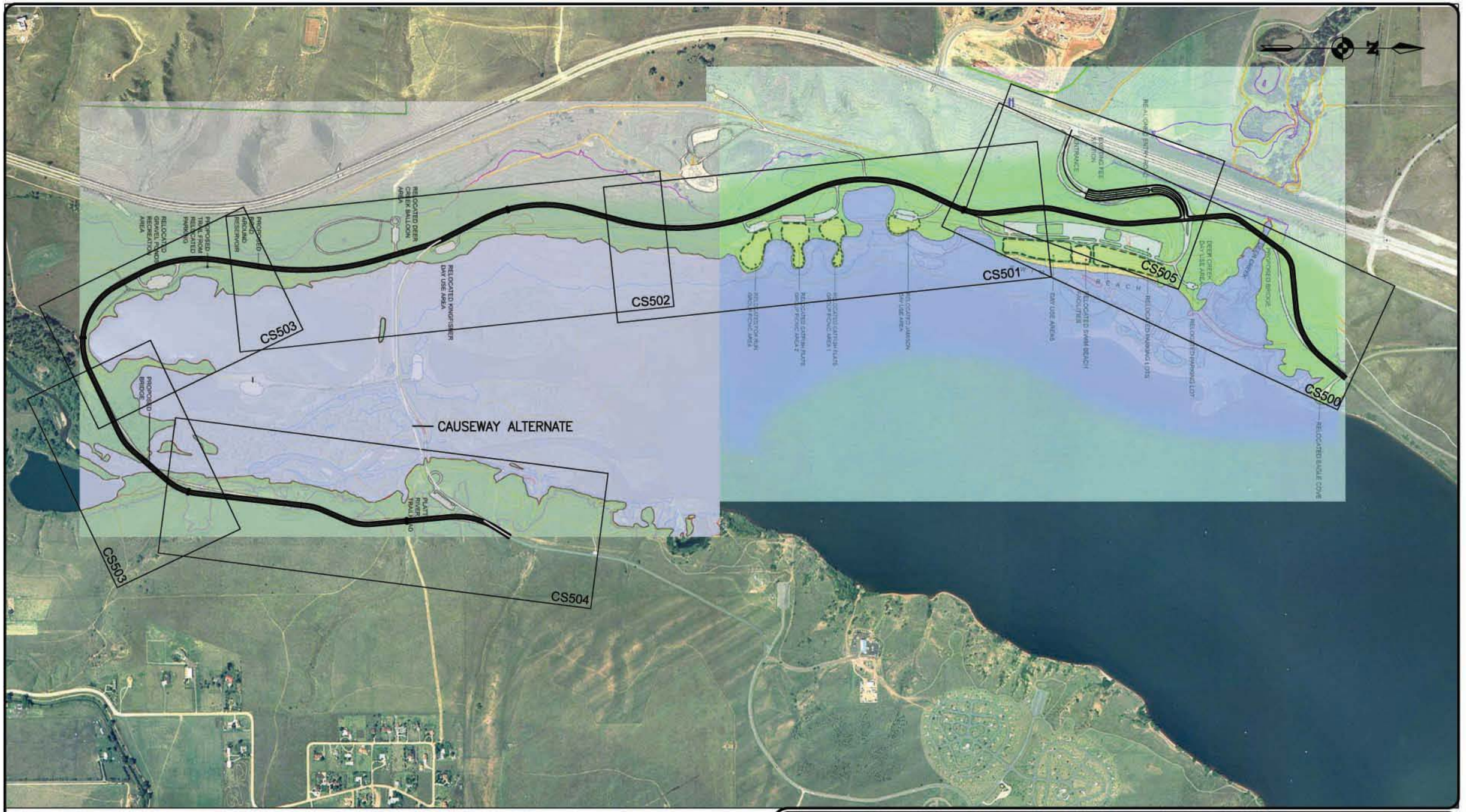
7. The unit costs for the opinion of probable construction cost were obtained by comparing recent bids of current roadway construction projects located in the Front Range. The costs were from publicly bid projects and are adjusted based on engineer's judgment where appropriate to be consistent with the level of work expected for this project.

Investigations

On December 19, 2003, a site visit was held with EDAW, CWCB, Sear-Brown, and CTL Thompson to make a visual observation of the existing soil conditions along the proposed alignment. Mr. Frank Holliday, CTL Thompson, was selected to perform this review and provide his conceptual level recommendations based on his knowledge of and experience with the soils in this part of the Denver area. Mr. Holliday made a visual reconnaissance of the types of soils present along the proposed roadway alignment to attempt to identify areas of potential concern that may impact the feasibility or cost of constructing a roadway along the alignment. Mr. Holliday's observations generally indicate that the soils northerly of the Deer Creek crossing appear to be clay over claystone bedrock which are expansive type soils. For the roadway southerly of Deer Creek appear to be a variable thickness of clays overlying alluvial sands and gravels mixed with some cobbles and probably boulders. Mr. Holliday provided some possible methods to deal with potential construction issues but did not observe any geologic or geotechnical conditions that would preclude building the roadway in the proposed alignment on the conceptual plan. For the complete text of CTL Thompson's observations, refer to the letter dated January 6, 2004 from CTL Thompson to Sear-Brown.

Route Selection

In the original concept plan there were two possible roadway alignments that were reviewed by the design team. Both alignments were identical along the west side of the existing reservoir to the point where the current roadway turns easterly around the southern side of the reservoir towards the Platte River crossing. At this point one option was to use this existing alignment and significantly raise the roadway above the new water elevation and effectively creating a causeway across the south end of the reservoir including a new bridge crossing of the Platte River. The second option was to construct a new roadway around the south end of the what would be the new reservoir water levels and make a new crossing of the Platte River. Both of these alignments were reviewed with State Parks and the design team and it was decided by State parks that for operational concerns it would be preferable to construct a new roadway around the south end of the expanded reservoir rather than to build a causeway across it. To that end, a conceptual level design and cost estimate was completed for only the option of extending a new roadway around the south end of the expanded lake. The selected route would be a new roadway approximately 4.1 miles in length including two new bridges.



HORIZ. 0 1200

PROJECT ENGINEER/ARCHITECT: M. CARR
PROJECT MANAGER: B. CUMMOCK
DRAWN BY: B. JORDAN
SCALE: 1" = 200'
FIRST ISSUE DATE:

SEAR·BROWN
209 South Meldrum
Ft. Collins, CO. 80521-2603
(970) 482-5922
Fax:(970) 482-6368
www.searbrown.com

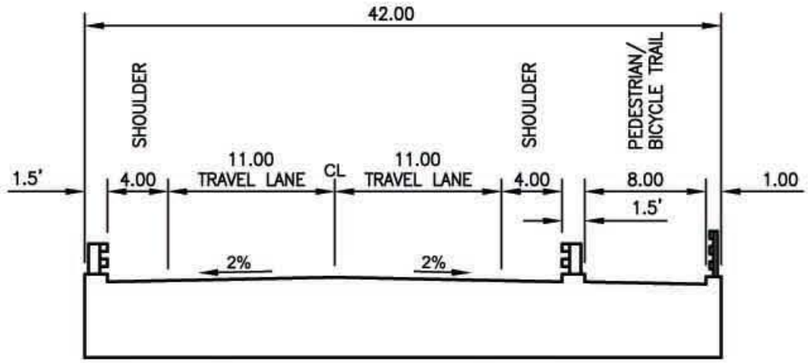
PROJECT
CHATFIELD STATE PARK
RECREATIONAL MITIGATION STUDY
ROADWAY FEASIBILITY ANALYSIS

TITLE OF DRAWING
OVERALL ROADWAY PLAN

PROJECT NO.
1010001

DRAWING NO.
CS100

SHEET 1 OF 8



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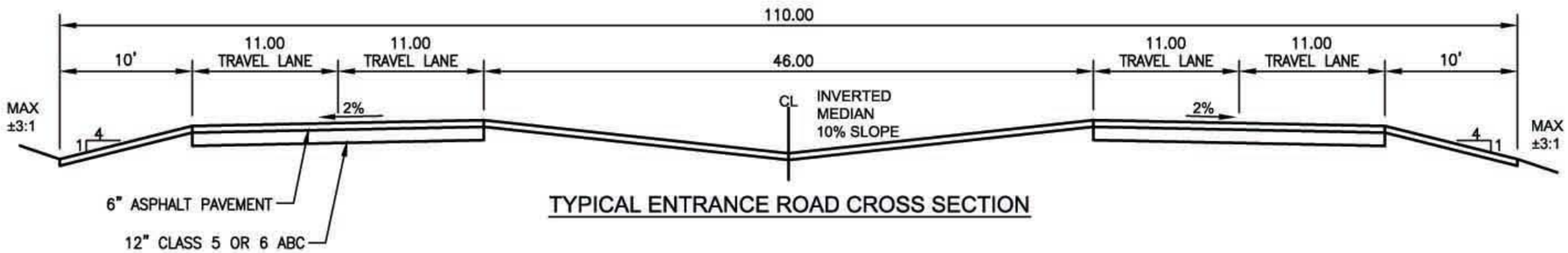

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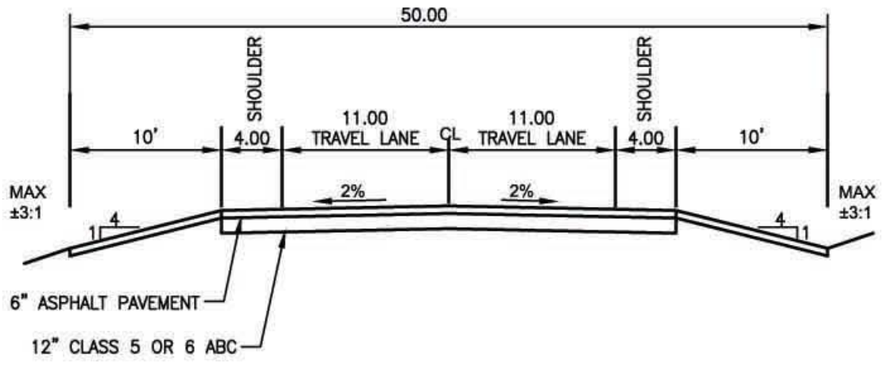

TYPICAL ROAD CROSS SECTION

0 10

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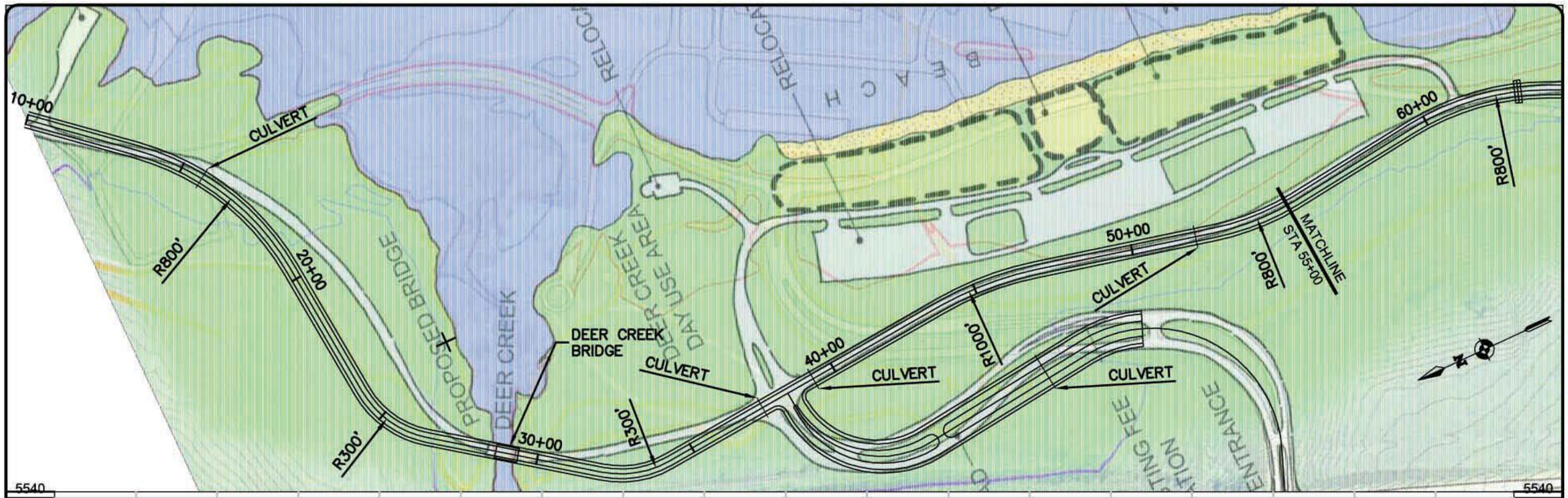
ROADWAY FEASIBILITY ANALYSIS

TITLE OF DRAWING: TYPICAL ROAD SECTIONS

PROJECT NO. 1010001
DRAWING NO. CS200
SHEET 2 OF 8



HORIZ. 0 300

VERT. 0 50

SCALE IN FEET

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PROJECT: CHATFIELD STATE PARK RECREATIONAL MITIGATION STUDY ROADWAY FEASIBILITY ANALYSIS

TITLE OF DRAWING: ROAD PLAN & PROFILE

PROJECT NO. 1010001

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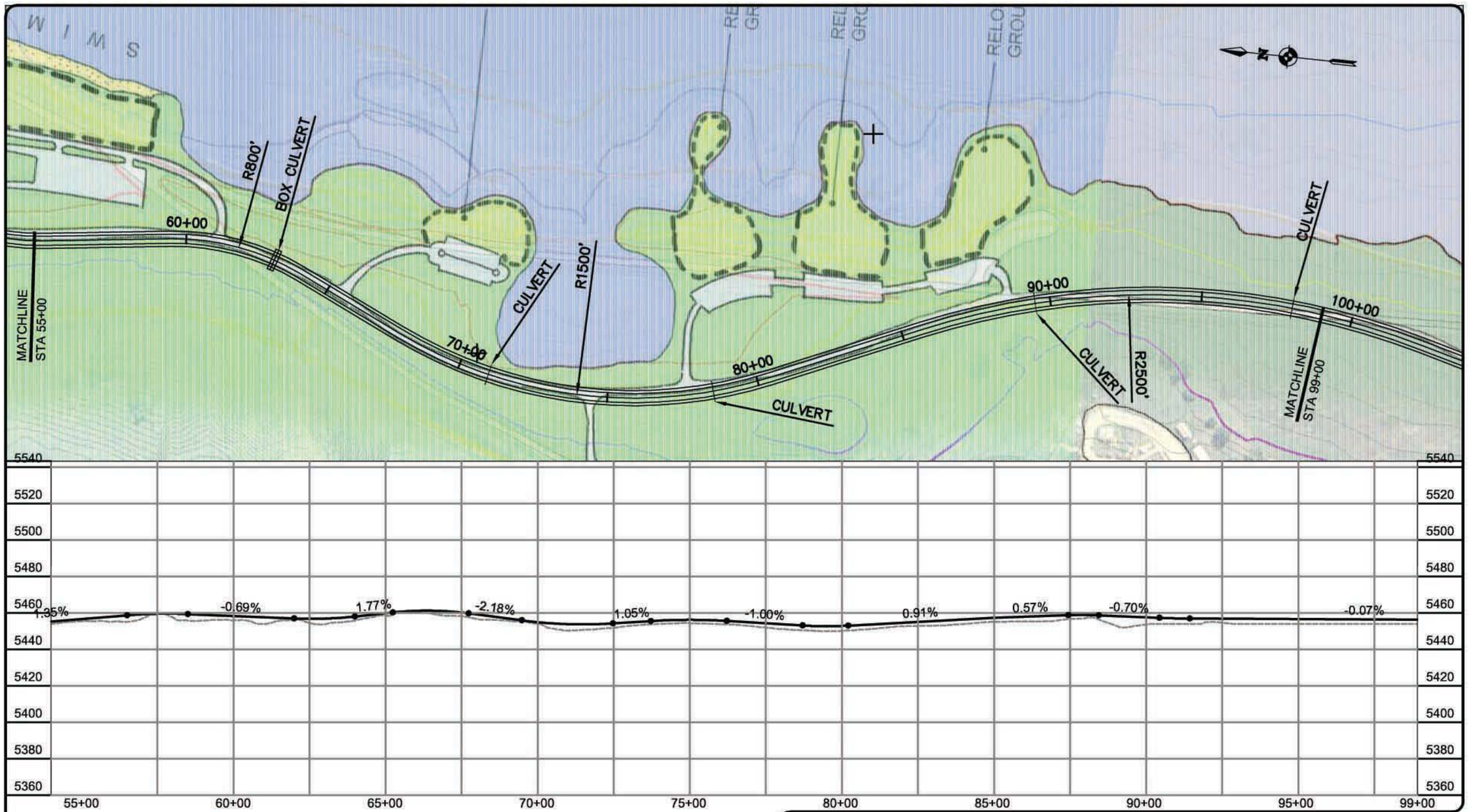

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SCALE IN FEET

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TITLE OF DRAWING: ROAD PLAN & PROFILE

PROJECT NO. 1010001
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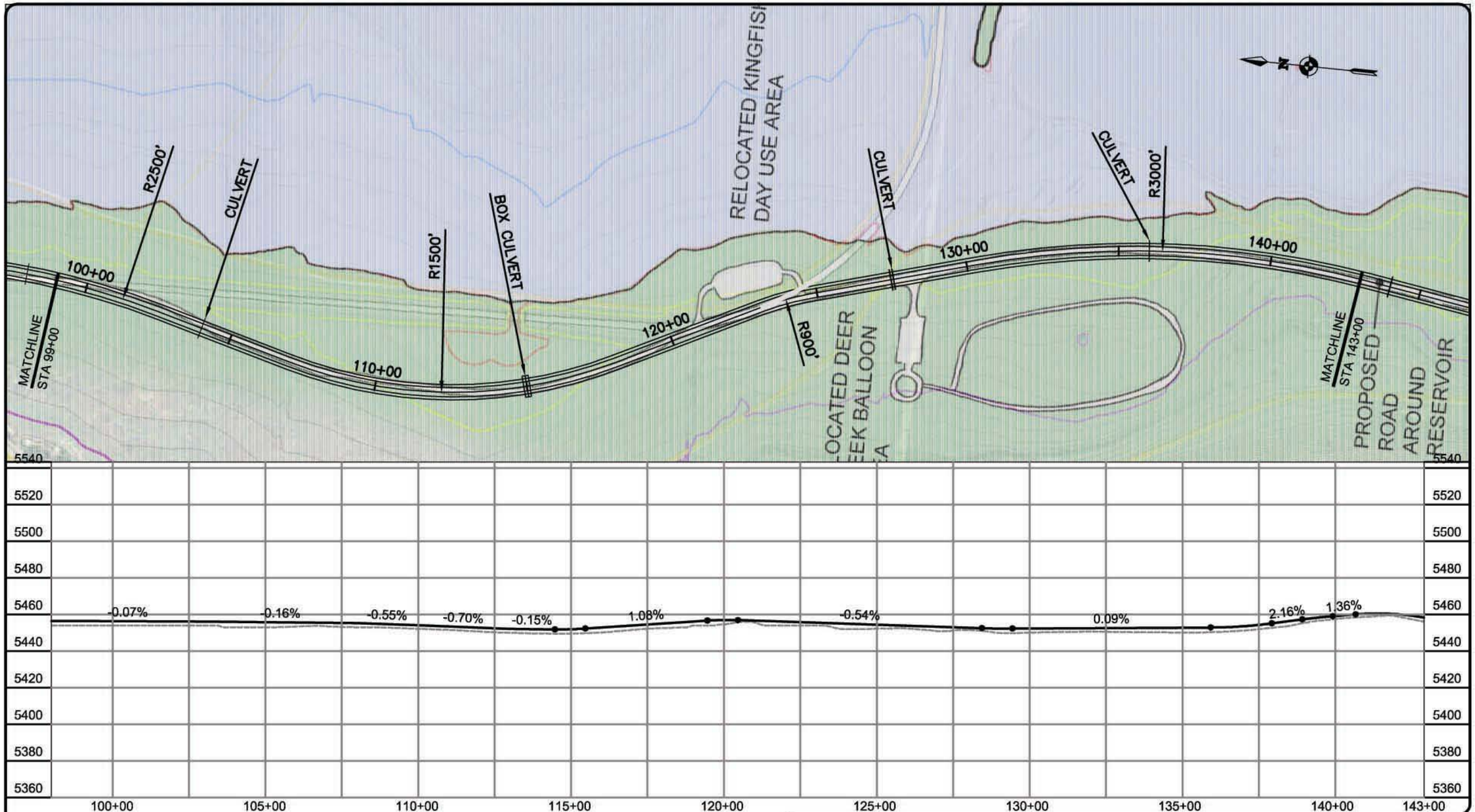

HORIZ. 0 300

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SCALE IN FEET

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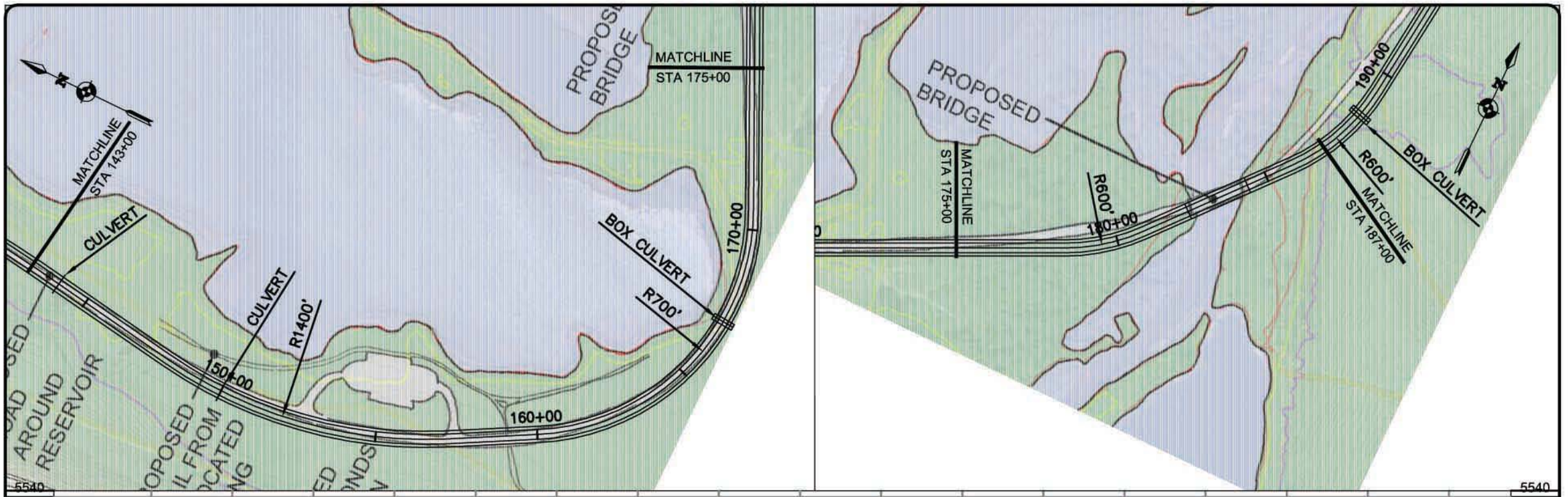
TITLE OF DRAWING: ROAD PLAN & PROFILE

PROJECT NO. 1010001

DRAWING NO. CS502

SHEET 5 OF 8



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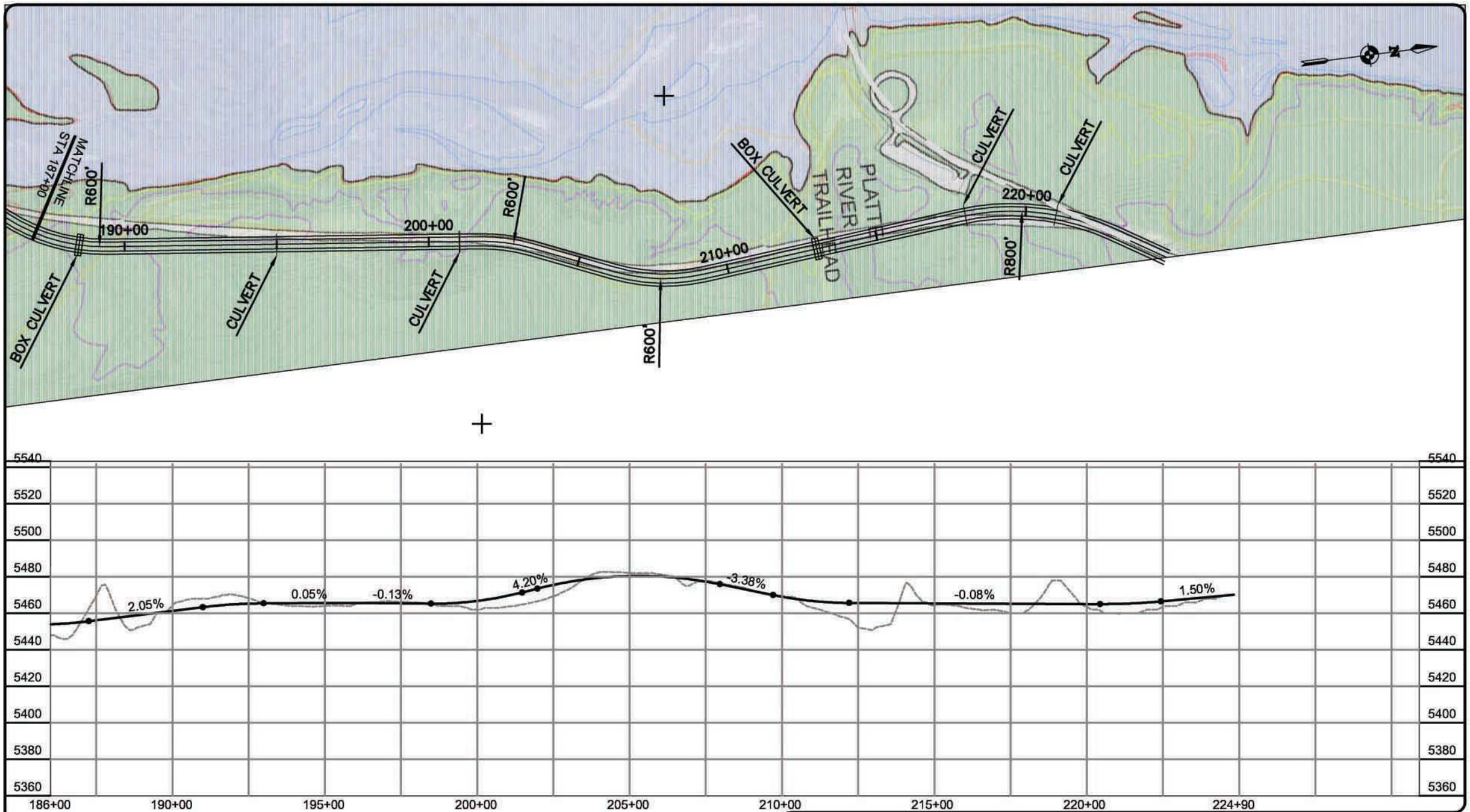
TITLE OF DRAWING: ROAD PLAN & PROFILE

PROJECT NO. 1010001
DRAWING NO. CS503
SHEET 6 OF 8



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SCALE IN FEET

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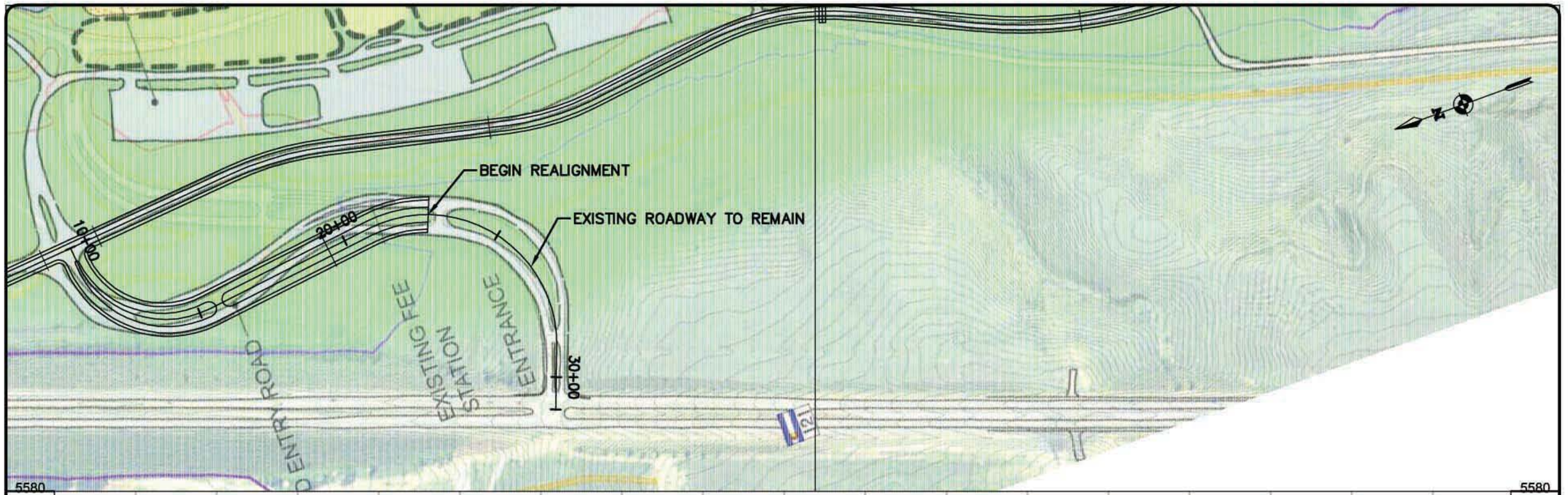
TITLE OF DRAWING: ROAD PLAN & PROFILE

PROJECT NO. 1010001

DRAWING NO. CS504

SHEET 7 OF 8



HORIZ. 0 300

VERT. 0 50

SCALE IN FEET

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TITLE OF DRAWING
ENTRANCE PLAN AND PROF LE

PROJECT NO.
1010001

DRAWING NO.
CS505

SHEET 8 OF 8

Appendix 3. Gravel Pond Protection

Boyle Engineering
215 Union Blvd., Suite 500
Lakewood, CO 80228

TECHNICAL MEMORANDUM

Date:	December 18, 2008
To:	Tom Keith, EDAW|AECOM Scott Sinn, EDAW|AECOM
From:	Blaine Dwyer and Wendy Daughtry, Boyle|AECOM
Subject:	Chatfield Reservoir Storage Reallocation – Mitigation Support

1.0 INTRODUCTION AND BACKGROUND

As part of the on-going mitigation planning for the Chatfield Reservoir Storage Reallocation Project (Project), Boyle|AECOM has been retained by EDAW|AECOM to assess layout options, potential costs, and the practicality of protecting the large Gravel Pond at the south end of Chatfield Reservoir.

The Project proposes a new reservoir operating elevation of 5,444 ft. At this elevation, the Gravel Pond will be inundated as will a segment of the park road north of the Gravel Pond and other facilities in the surrounding area (including a parking area on the east side of the Gravel Pond). Currently, the Gravel Pond reportedly has greater water clarity than the overall reservoir and some of the Pond's existing recreational uses, primarily scuba diving and triathlon training, are expected to be negatively affected by the inundation and anticipated diminished water clarity. (EDAW, 2006) To preserve the Pond's existing water quality and recreational uses, the feasibility of an earthen dike around the Gravel Pond is being considered.

A Concept Memorandum prepared by Boyle dated November 25, 2008, presented conceptual alternatives for the dike including geotechnical designs and preliminary earthwork quantities. The memorandum further discussed dike geometry and layout, site geologic conditions, and potential borrow sources. Upon review of the Concept Memorandum and based on discussions held at a December 5, 2008 meeting with project participants, Boyle was asked to look at two new conceptual dike alternatives.

This memorandum is a follow up to the November 25, 2008 Concept Memorandum and provides preliminary feasibility assessments, including ranges of probable costs, for the two new dike alternatives.

2.0 DIKE ALTERNATIVES

2.1. Alternative 1

For Alternative 1, the park road is routed around the south end of Chatfield Reservoir, beyond the Gravel Pond, resulting in the need for a small dike along the north and east perimeter of the Gravel Pond. For reference, a plan of the proposed Alternative 1 conceptual dike design is attached.

2.1.1. Crest Height

The proposed new normal water level (NWL) for Chatfield Reservoir is 5,444 ft. Based on our understanding and per meeting discussions with project participants on December 5, 2008, the purpose of the proposed dike around the Gravel Pond is to isolate the Pond from the main reservoir pool at the new NWL so that the Gravel Pond's existing water quality and recreational uses can be preserved under normal reservoir operations. The dike is expected to be overtopped whenever the main reservoir pool rises above 5,444 ft. When overtopping does occur, no immediate threat to facility improvements or the public is anticipated since the Gravel Pond area is ultimately within the Chatfield Reservoir area of inundation. Therefore, based on the intended function of the dike, a base crest height of 5,444 ft was selected.

Per USACE guidance as described in Section 3.0, a freeboard of 6 feet for the north dike and 2.5 feet for the east dike was added to the dike crest height to account for estimated wave run-up, wind setup, and embankment settling. The resulting crest elevations of 5,450 ft and 5,446.5 ft were used for the north and east dikes, respectively.

The vertical transition of the crest heights, from 5,450 ft to 5,446.5 ft, was made at a 5% slope.

2.1.2. Dike Layout and Crest Width

The north dike ties into elevation 5,450 ft at the northwest corner of the Gravel Pond. The north dike extends east along the north shoreline of the Gravel Pond then rounds the northeast corner of the Pond and transitions into the east dike which is at elevation 5,446.5 ft. The east dike is generally aligned with the eastern shoreline of the Gravel Pond until it ties back into the existing topography.

EDAW provided USACE hydrologic study data for simulated Chatfield Project operations at the 5,444 ft NWL that showed historical maximum reservoir levels over a 58 year period (1942-2000). Under that scenario, the reservoir level exceeded elevation 5,446.5 ft only six times during the 58 years. Based on this information, the 5,446.5 ft east dike crest elevation appears to be set at a reasonable height for maintaining the general intent of the Gravel Pond dike.

Based on meeting discussions from December 5, 2008, the Alternative 1 dike crest width was set at 12 ft to allow for emergency and/or maintenance vehicle access. The east dike will not serve as a public park roadway.

2.2. Alternative 2

For Alternative 2, the existing park road alignment and S. Platte River crossing north of the Gravel Pond is maintained thus requiring a raised north dike of appropriate crest width to accommodate the given roadway section. In addition, to fully isolate the Gravel Pond area,

a smaller dike that ties into the north dike would be required along the east side of the Gravel Pond. For reference, a plan of the proposed Alternative 2 conceptual dike design is attached.

2.2.1. North Dike Crest Height

As previously stated for Alternative 1, the general intent of the Gravel Pond dike is to retain the main reservoir's proposed NWL (5,444 ft). In addition to this function, for Alternative 2 the top of the north dike must also serve as the park road and South Platte River crossing. Per meeting discussions on December 5, 2008 with project participants, it was determined that the Alternative 2 dike road and bridge crossing should be preliminarily designed to, at a minimum, maintain the current conditions of the existing park road and bridge crossing (i.e., replace in-kind). Under current conditions, the Chatfield NWL is 5,432 ft and the existing bridge deck elevation is 5,445 ft which is an elevation difference of 13 ft. Placing the proposed north dike road/bridge crossing 13 ft above the new Chatfield Reservoir NWL (5,444 ft) results in a north dike crest elevation of 5,457 ft.

Per USACE guidance as described in Section 3.0, a freeboard of 6 feet was estimated for the north dike to account for wave run-up, wind setup, and embankment settling. Since the north dike crest elevation is set 13 feet above the base crest height (5,444 ft), the 6 feet of freeboard is incorporated in the 13 feet.

2.2.2. North Dike Layout and Crest Width

The north dike follows the current park road alignment north of the Gravel Pond and includes the embankment fill for the raised roadway approach and bridge abutments on both sides of the existing South Platte River crossing. Since the top of the north dike will also serve as the park road, the north dike crest width was set at 46 ft based on the required park roadway section provided by EDAW. The roadway section includes two 12 ft travel lanes, two 6 ft bike lanes, two 1 ft shoulders, and an 8 ft wide concrete trail.

A short spur dike is proposed at the far west end of the north dike alignment to tie the dike crest elevation back into the existing topography. Continuing the north dike along the existing park road alignment would require raising the road profile to the dike elevation for a significant distance before catching an existing contour crossing the road at that same elevation. For this conceptual design, the spur dike was selected as the preferred alternative, as opposed to raising the road profile, to minimize the amount of fill material.

2.2.3. East Dike Crest Height

The east dike will not serve as a public park roadway, therefore, elevation 5,444 ft was selected as the base crest height. Per USACE guidance as described in Section 3.0, a freeboard of 2.5 feet was added to the east dike crest height to account for estimated wave run-up, wind setup, and embankment settling. The resulting crest elevation of 5,446.5 ft was used for the east dike conceptual design. This crest elevation appears to be reasonable based on provided USACE hydrologic data discussed under Alternative 1.

The vertical transition of the crest heights, from 5,457 ft to 5,446.5 ft, was made at a 5% slope.

2.2.4. East Dike Layout and Crest Width

The east dike connects to the north dike at the location of the existing parking lot access road and extends south along the east side of the Gravel Pond. The east dike is generally aligned with the eastern shoreline of the Gravel Pond until it ties back into the existing topography. Based on meeting discussions from December 5, 2008, the east dike crest width was set at 12 ft to allow for emergency and/or maintenance vehicle access.

2.3. Dike Overflow

The proposed Gravel Pond dike will be subject to fairly frequent overtopping due to the low crest elevation on the east dike (only 2.5 feet above the reservoir NWL for both Alternatives 1 and 2), making the dike more susceptible to failure. To help protect the dike embankment from washouts, an armored overflow section is proposed on the east dike. The overflow section is intended to protect the dike embankment by allowing the flow to pass into the Gravel Pond area at a specified location that is sufficiently armored to protect against erosion. Subsequently, allowing the water surface on the Gravel Pond side of the dike to rise with the main reservoir pool can help stabilize the dike embankment during overtopping and fluctuating water surface elevations. Dike overtopping will ultimately occur when the main reservoir pool rises more than 2.5 feet above the NWL.

Based on USACE guidance on dam breach characteristics, a 25 ft wide, riprap-armored overflow section was assumed for this conceptual design. (USACE, 1997) The proposed overflow section is presumed to be set slightly above the NWL (i.e., 6-inches; 5,444.5 ft) so that reservoir overflows do not occur during minor fluctuations of the NWL. Overall, the Gravel Pond dike should be designed to withstand fairly frequent overtopping; therefore, the embankment structure and dike stability should be further analyzed and evaluated during preliminary design.

2.4. Side Slopes

Based on prior experience and USACE guidance, the dike outer slopes, both upstream and downstream, are assumed as 3H:1V for conceptual design layout. The influences of geotechnical considerations on the side-slopes are further discussed in Section 4.0.

3.0 FREEBOARD DESIGN

A freeboard height was estimated for both the north and east dikes based on USACE procedures for wave run-up, wind setup, and embankment settling. (USACE, 1976) The north dike is subject to a longer fetch across the proposed raised reservoir pool and thus results in a greater freeboard requirement than the east dike. The resulting required freeboard for the north dike is estimated to be 6 feet. The east dike will experience substantially less wave run-up and wind setup than the north dike given the minor fetch length of the adjacent raised reservoir pool. The resulting required freeboard for the east dike is estimated to be 2.5 feet.

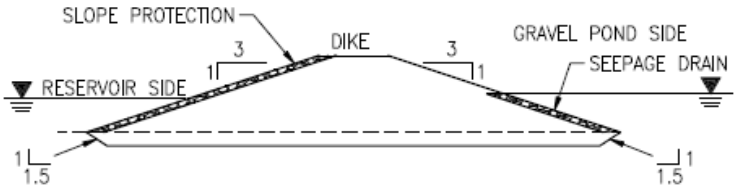
4.0 GEOTECHNICAL DESIGN

The Concept Memorandum presented two alternative geotechnical designs: 1) pervious dike and foundation; and 2) impervious dike and foundation with seepage control. After review of the proposed geotechnical designs, project participants chose to proceed with the pervious dike and foundation alternative; therefore, all discussions in this memorandum regarding the new conceptual dike alternatives assume the pervious design.

4.1. Pervious Dike and Foundation

The pervious concept would allow potentially significant seepage/leakage from the raised reservoir pool to penetrate the dike and its foundation resulting in higher pool level in the Gravel Pond (and conversely lower Gravel Pond pool levels during periods of sufficiently lowered reservoir pool). Under this concept the proposed dike would be constructed of predominantly granular fill available from a local to nearby source. The dike would be designed as an essentially homogeneous section (i.e., constructed of all the same type of material) with a downstream filter zone to allow for safe discharge of seepage to the Gravel Pond (i.e., discharge without the potential for internal erosion or piping of the fill). The filter zone would be constructed of processed aggregate filter compatible with the homogeneous granular fill. The outer slopes of the embankment are assumed as 3H:1V both upstream and downstream. Such slopes should be adequately stable given the anticipated and assumed embankment materials, foundation conditions, and loadings (static, seepage, and seismic) based on prior experience and standard USACE design guidance. (USACE, 2004) Seepage and stability should be further evaluated and analyzed at preliminary design.

Foundation preparation would consist of stripping shallow soils that are loose and/or contain organic matter (preliminary assumed as 1-2 feet maximum depth). Cutoff of the alluvial aquifer would not be included in this alternative concept. It is assumed for the purposes of this study that internal erosion or piping of the finer fraction of the shallow alluvial foundation into the Gravel Pond under seepage gradients from the raised reservoir pool to the Gravel Pond pool (or in the opposite direction during low reservoir pool conditions) would not occur. It will be important to verify or revise this assumption based on site-specific investigations and analyses if this alternative is to be further considered.



PERVIOUS CONCEPT
SCALE: NTS

4.2. Foundation Rockfill

The Concept Memorandum showed the placement of foundation rockfill along the pond banks in locations where the dike embankment would encroach the Gravel Pond and smaller pond to the east. For both dike alternatives discussed in this memorandum, the proposed dike on the east side of the Gravel Pond no longer encroaches the ponds due to the reduced base width; therefore, foundation rockfill is not longer included.

4.3. Slope Protection

Slope protection on the reservoir-side of the dike slopes would be provided, as appropriate, due to the potential for wave erosion. The method of slope protection ultimately selected would depend on the degree of protection required and availability of materials. Methods that would be considered include conventional rock riprap, soil cement, manufactured products (i.e., gravel-filled geoweb, articulated concrete block), and/or reinforced vegetation. Greater protection would be required on the north dike that would be exposed to a significant fetch across the reservoir. Slope protection requirements on the east dike would be less (e.g., potentially smaller riprap size) given the minor fetch length of the adjacent raised reservoir pool in this area.

Erosion protection for side-slopes on the Gravel Pond side may not be required depending on the gradation of the granular embankment fill. If needed, placement of topsoil and grass seeding could be considered with or without synthetic reinforcement (depending on specific site conditions).

4.4. Park Road and Bridge

The raised park road embankment, the extension of the north dike east of the east dike (Alternative 2), would utilize the pervious design concept described above but without the downstream filter/drain zone. Given that water levels on both sides of this embankment would always be the same there is no apparent potential for sustained seepage through the embankment or foundation and accompanying internal erosion or piping. Other than stripping of loose and/or organic surficial soils, no foundation treatment is anticipated. Slope protection would be as described previously for the dike concepts.

5.0 GEOLOGIC CONDITIONS

Preliminary interpretations of geologic conditions along the proposed dike, park road, bridge abutments, and adjacent ground are based on subsurface exploration by others (USACE, 1974) and site reconnaissance conducted by Boyle|AECOM staff on November 11, 2008. These interpretations are the basis for the geotechnical aspects of the conceptual alternatives described in this memorandum. Site subsurface exploration and geotechnical testing will be required to confirm, modify and/or extend these interpretations and to gather additional geologic/geotechnical information to support further evaluation and ultimately design of a selected alternative.

The dike and park road/bridge alignments are underlain by thin surficial soils with some organic content. The depth of these soils appears to be on the order of inches rather than feet based on available exposures in the eroded banks of the gravel ponds at the site. Where vegetation is present, soils tend to be slightly deeper; grass roots are expected to be shallow (on the order of the depth of the soil layer) while willow and cottonwood roots may extend deeper into the alluvial deposits. The surficial soils have developed on underlying alluvial deposits of the South Platte River floodplain. Depths of alluvium at the two boring locations in the vicinity of the existing park road bridge crossing of the S. Platte River are 9 and 36 feet (USACE, 1974). Based on these borings and the alluvial valley setting of the project site, it is estimated that the depth of alluvium may vary between as little as 10-15 feet to as much as 35-40 feet or more beneath the dike and park road embankment alignments. The alluvial deposits are likely predominantly silty to gravelly sand and sandy gravel, with local lenses of sandy clay to clayey sand/gravel. The alluvium is underlain by siltstone and sandstone of the Dawson Formation at the boring locations and it is anticipated that this bedrock unit also underlies the dike and park road raise alignments. These bedrock units are reported to be soft to moderately hard, unweathered to moderately weathered, and slightly to locally highly fractured. The sandstones are calcareous and moderately cemented.

Although not known with certainty pending site-specific subsurface investigations, it is judged likely that the alluvial deposits underlying the site area are an unconfined groundwater aquifer. If the water surface in the existing ponds at the site are assumed coincident with the local groundwater table, then the elevation of the groundwater table beneath the proposed Gravel Pond dike alignment (as inferred from the adjacent pond water levels) is on the order of 4-5 feet higher than the South Platte River to the east. Assuming the unconfined groundwater table discharges to the river, a groundwater gradient on the order of 0.005 toward the river is estimated. Based on this inferred gradient, the boring log descriptions cited previously, and the presence of a number of abandoned shallow alluvial wells in the site area, it is judged that the alluvial deposits underlying the site are moderately to locally highly permeable. Under this preliminary groundwater concept for the site area, it is inferred that the primary source of water in the Gravel Pond and other water filled gravel pits in the vicinity is recharge to the shallow alluvial aquifer from the South Platte River upgradient (i.e., upstream) of the Gravel Pond.

6.0 BORROW SOURCES

A preliminary assessment has been made of potential borrow sources to provide the earth materials necessary for the dike concepts described previously. Potential sources include but are not limited to:

6.1. Chatfield State Park

Alluvial and colluvial deposits are present on the slopes of the existing reservoir. Potential advantages associated with this source include: short haul distance; no royalty cost (assuming mineral rights are currently held by State Parks); ongoing environmental evaluation and permitting process; minimal reclamation requirements if borrow site is below proposed raised pool elevation; abundant granular material; and gain of reservoir storage capacity if borrowing is within limits of raised reservoir pool. Known and potential disadvantages include: uncertainty as to availability of low permeability (i.e., high fines, plastic) soils; and potential dewatering requirements (depending on elevation of borrow area relative to South Platte River and/or reservoir pool).

6.2. Commercial Aggregate Pits

Pit run and processed alluvial sands and gravels are available from commercial sources in the general vicinity of the site. These sources may also provide fine-fraction reject (likely non-plastic) and oversize cobbles/boulders. Potential advantages of these sources include: the ability to specify required gradations (or select from standard gradations); no project-required permitting or reclamation; and the resulting relatively short-notice availability of the materials. Potential disadvantages include: oversize materials predominantly rounded and limited in size; and royalty (i.e., purchase) and haul costs. The closest commercial aggregate supplier to the site is within approximately 4 road miles; other suppliers are located considerably further away and haul costs would increase significantly if one of these sources was used.

7.0 PRELIMINARY EARTHWORK QUANTITIES

Preliminary order of magnitude estimates of earthwork quantities for the pervious geotechnical design (refer to Section 4.0) have been made for the two conceptual dike alternatives identified and evaluated in this memorandum. These quantities are summarized as follows:

Alternative 1	Earthwork Quantities (CY)	Alternative 2	Earthwork Quantities (CY)
		North Dike	
Stripping Excavation	15,000	Stripping Excavation	36,000
Fill Material		Fill Material	
Seepage Drain	5,000	Seepage Drain	6,000
Embankment Fill [A]	51,000	Embankment Fill [A]	235,000
Slope Protection [B]	4,000	Slope Protection [B]	7,000
Overflow (Riprap)	200		
		East Dike	
		Stripping Excavation	10,000
		Fill Material	
		Seepage Drain	3,000
		Embankment Fill [A]	33,000
		Slope Protection [B]	2,000
		Overflow (Riprap)	200
Total Fill Material	**60,200**	**Total Fill Material**	**286,200**

Note that these estimates are based on the assumptions regarding site geologic conditions, preliminary dike/foundation layouts, and the pervious geotechnical design concept discussed previously. These estimates should be expected to change based on site specific investigations and more refined design as part of further evaluation of a selected concept.

[A] Embankment fill quantities include material quantities for backfilling stripping excavation.
[B] Slope protection is assumed to be riprap and bedding.

8.0 CONCEPTUAL OPINIONS OF PROBABLE COSTS

Conceptual opinions of probable costs have been prepared for the two alternative dike concepts evaluated in this memorandum. These cost estimates were developed based on the conceptual level designs detailed above and on our knowledge and experience with similar types of projects in the region. Due to the currently unspecified source of dike embankment fill material, opinions of probable costs have been prepared considering both onsite and offsite borrow (import) sources.

For onsite borrow source cost estimates, the total construction costs reflect a short haul distance, material placement and compaction, and assume that the material would be in suitable condition for direct placement requiring no additional drying or extra processing (i.e., over and above the effort required for typical compactive fill). At this time, locations of potential onsite borrow have not been identified; therefore, it is unknown if onsite borrow material is available or suitable for use in the dike embankment fill. For provided onsite borrow source opinions of probable costs, it was assumed that onsite borrow material is available and acceptable for use in constructing the dike embankment.

For offsite borrow source (import) cost estimates, the total construction costs reflect material purchase price, haul distance, material placement and compaction, and assume that the material would be in suitable condition for direct placement requiring no additional drying or extra processing. For both dike alternatives, it was assumed that riprap/bedding for the shoreline protection and east dike overflow section and the drain/filter material would be obtained from offsite borrow sources due to the specific gradation requirements of the materials.

The opinions of probable costs are provided below:

Conceptual Dike Alternative	Opinion of Cost (Onsite Borrow)	Opinion of Cost (Offsite Borrow)
Alternative 1	$1.0 Million	$3.0 Million
Alternative 2 (North and East Dike)	$2.8 Million	$10.5 Million
Alternative 2 (North Dike Only)	$2.3 Million	$9.0 Million
Alternative 2 (East Dike Only)	$0.5 Million	$1.5 Million

The estimated construction costs for the two conceptual dike alternatives incorporates anticipated variations in the import material unit pricing due to the amount of import material required for the different alternatives. For example, it is expected that the unit price per cubic yard of import embankment fill for Alternative 1 will be more than the embankment fill unit price for Alternative 2 since less import fill material is needed for Alternative 1 than Alternative 2 (i.e., economies of scale).

The estimated construction costs include an allowance for “unlisted items” equal to 20% of the listed items. This allowance provides an estimate for a variety of items that would eventually be included in a detailed cost estimate.

The estimated construction costs also include an allowance for construction contingencies equal to 20% of the base construction cost. Construction contingencies are included to account for undefined or unanticipated conditions as well as project construction cost increases that could result from a variety of factors including:

- Project components and requirements not yet itemized or identified
- Unforeseen conditions or unexpected project development issues
- Special USACE design/construction requirements (i.e., roadway/bridge design, reinforced embankments, flood protection measures)
- Approximations in estimating
- Other unforeseen or unexpected costs

An allowance for the construction contractor's costs for mobilization and demobilization is also included as 7% of the of base construction cost.

The estimated construction costs for Alternative 2 are provided in three different scenarios: 1) the estimated cost for the north and east dike combined; 2) the north dike only; and 3) the east dike only. For each of these scenarios, the provided opinions of costs include only those direct construction costs associated with the identified scenario. Allowances for unlisted items, construction contingencies, and contractor mobilization/demobilization are also included.

Note that these opinions of costs are limited to the assumptions and availability of information previously discussed and only assume those costs associated with direct construction. These opinions of costs do not include roadway surfacing nor allowances for field exploration, design, recreation or environmental mitigation, restoration of onsite borrow sources, permitting, legal/administrative, construction management, or quality assurance. Project participants are recommended to include allowances for these costs in their overall planning level estimates.

9.0 PRELIMINARY CONCLUSIONS

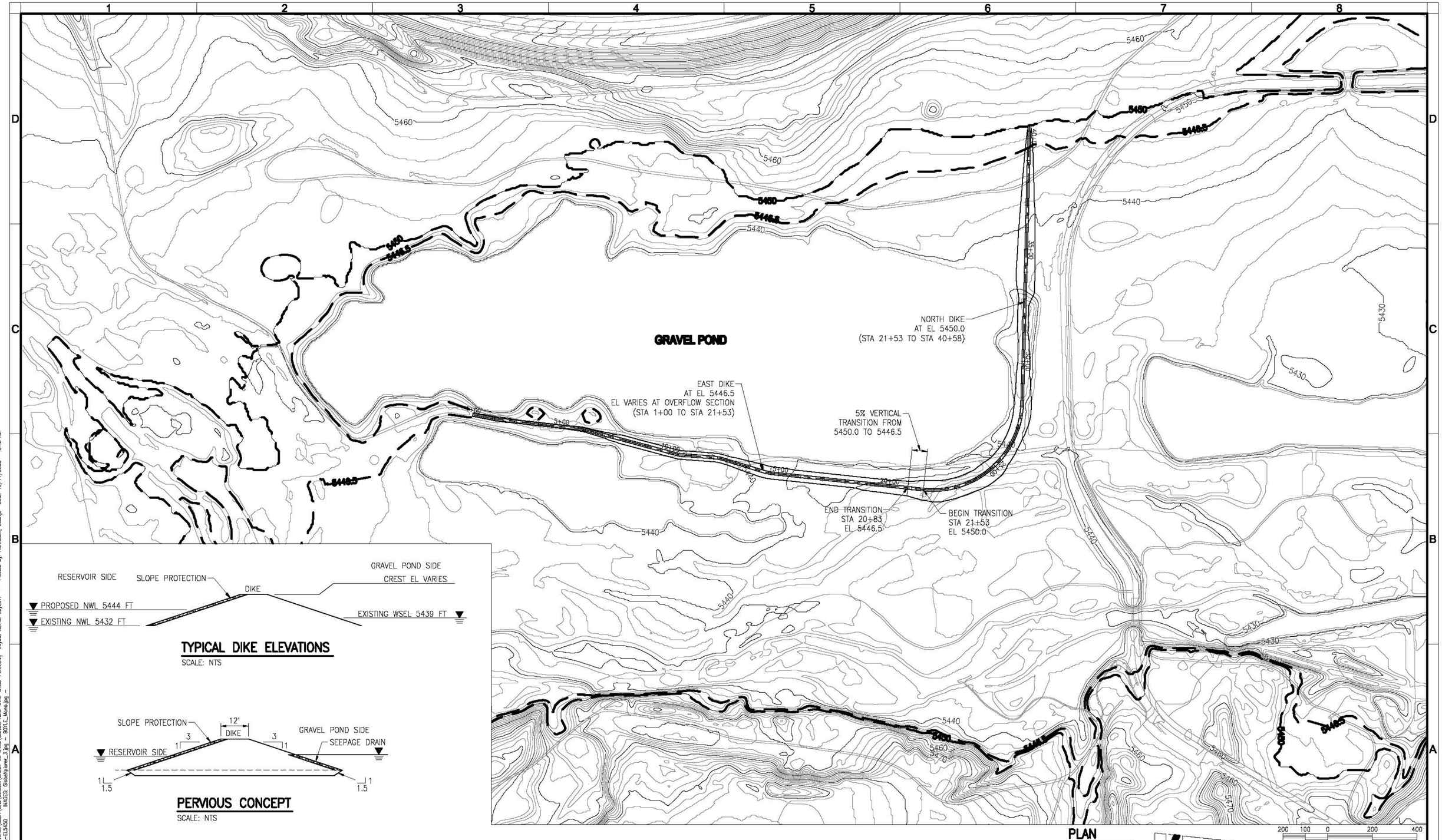
Preliminary conclusions from the conceptual evaluations performed to date and described herein are summarized as follows:

- Construction of a dike to prevent direct inundation of the Gravel Pond by raising the Chatfield Reservoir normal water level appears technically feasible based on the conceptual level evaluations performed to date.
- Maintaining the existing park road alignment and South Platte River crossing location appears technically feasible.
- A pervious dike and absence of foundation cutoff would result in some response in Gravel Pond water level to changes in reservoir water level; estimating the degree and timing of response would require site specific investigations and analyses beyond the scope of this initial assessment.

10.0 REVIEW OF DOCUMENTS AND GUIDELINES

The following documents were reviewed as part of the evaluation covered under this concept memorandum:

1. Boyle|AECOM. *Chatfield Reservoir Storage Reallocation – Mitigation Support* (Concept Memorandum), November 25, 2008.
2. EDAW. Chatfield Reservoir cad files, topography, and surface features, 2008.
3. EDAW. Chatfield Reservoir hydrologic data, December 2008.
4. EDAW. *Chatfield Reservoir Recreation Study, Initial Mitigation Plan*, December 2006.
5. U.S. Army Corps of Engineers (USACE). *EM 1110-2-1420, Hydrologic Engineering Requirements for Reservoirs*, October 31, 1997.
6. U.S. Army Corps of Engineers (USACE). *EM 1110-2-2300, General Design and Construction Considerations for Earth and Rock-Fill Dams*, July 30, 2004.
7. U.S. Army Corps of Engineers (USACE). *ETL 1110-2-221, Wave Runup and Wind Setup on Reservoir Embankments*, November 29, 1976.
8. U.S. Army Corps of Engineers (USACE). *South Platte River Chatfield Lake, Colorado; Roads and Utilities – Stage III*, April 1974.



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TYPICAL DIKE ELEVATIONS
SCALE: NTS

PERVIOUS CONCEPT
SCALE: NTS

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DRAWN BY: GJH
CHECKED BY: BD
DATE:
PROJECT ENGINEER
REG NUMBER EXP DATE
PROJECT NUMBER 17445.00
CADD STANDARDS BOYLE

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LAKEWOOD, COLORADO 80228
(303) 987-3443
(303) 987-3608
www.boyle.aecom.com

CHATFIELD RESERVOIR MITIGATION

ALTERNATIVE 1
NORTH DIKE CREST ELEVATION 5450.0
EAST DIKE CREST ELEVATION 5446.5

DRAWING
SHEET 1 OF 1 SHEETS

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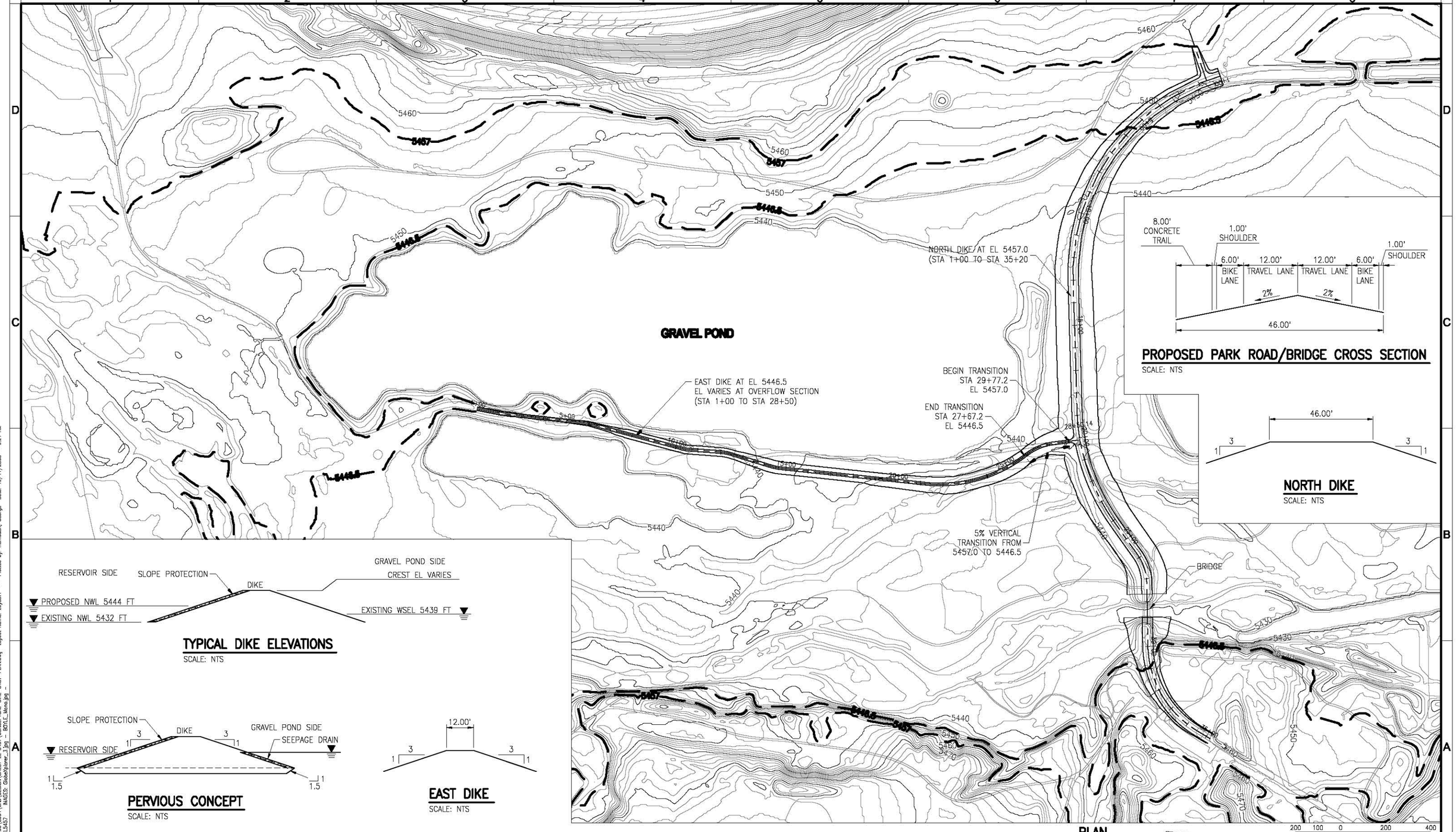

PROPOSED PARK ROAD/BRIDGE CROSS SECTION

SCALE: NTS

NORTH DIKE

SCALE: NTS

TYPICAL DIKE ELEVATIONS

SCALE: NTS

PERVIOUS CONCEPT

SCALE: NTS

EAST DIKE

SCALE: NTS

PLAN

SCALE: 1'=200'

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CHATFIELD RESERVOIR MITIGATION

ALTERNATIVE 2
NORTH DIKE CREST ELEVATION 5457.0
EAST DIKE CREST ELEVATION 5446.5

DRAWING

SHEET 1 OF 1 SHEETS

Appendix 4. Marina Operations

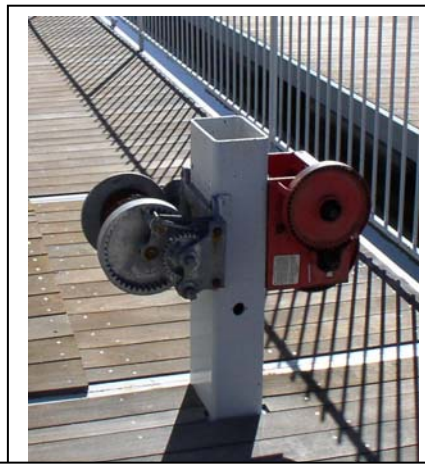
ISSUES

During the site visit and subsequent conversations with the marina owners, Colorado State Parks staff, and EDAW staff the following issues related to the marina operation was identified:

- Relocating the existing public restrooms above the new high water line will put undue pressure on the restrooms in the existing restaurant building
- The need to maintain the current anchoring scheme for the marina so the facility does not have to be routinely moved in and out during lake level fluctuations
- The existing breakwater does not have winches and cannot be adjusted sufficiently to allow for the increased lake fluctuation levels

Recommendations

To address the relocation of the existing public restrooms, we have the understanding that this will be accomplished with a land based unit.



To maintain the existing anchoring scheme and allow the marina owner to maintain the historic levels of maintenance effort and cost related to the anchoring, we are recommending that new anchors be constructed and installed and that all existing winches be replaced. When the average fluctuation of the lake is increased, the location of the existing anchors would not provide sufficient scope. A cost estimate was prepared to move the existing anchors, but that proved to be more expensive than providing new anchors in the correct location. Cost to place new anchors, replace existing cable to maintain existing scope ratios, and replace winches of $278,000 (rounded) is shown in Attachment A. Attachment B shows the scope ratio detail, Attachment C shows the anchor weight calculations, Attachment D shows the cost comparison of moving vs. replacing the existing anchors.

To allow the existing breakwater to be adjusted for the higher lake fluctuation levels we are recommending that 4 floatation platforms with winches be attached to the ends of the breakwater sections with new anchors placed. Attachment E shows the breakdown of the $32,000 (rounded) cost for the new winch platforms.

Cost Summary

Anchoring	$278,000
Breakwater winches	$32,000
Total	$310,000

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Page, AZ 86040

12.29.08

Attachment A

Chatfield marina- replacement cost of cable, winches, and anchors

Price quotations from D&M Wire Rope, Grand Junction, CO

Description	Quantity	Unit	Unit Cost	Total Cost
5/8" IWRC	ft	22700	$1.00	$22,700.00
Cable ends	ea	104	$10.50	$1,092.00
Freight	lump	1	$2,000.00	$2,000.00
Reel charge	ea	8	$40.00	$320.00
				$0.00
				$26,112.00
LM16 winch w/wide drum	ea	99	$1,525.00	$150,975.00
Freight	lump	1	$4,000.00	$4,000.00
				$154,975.00
Form and place new anchors	ea	33	$1,528.93	$50,454.69
Total				$231,541.69
Contingency- 20%				$46,308.34
Total				$277,850.03

Attachment B

Anchor cable #	Attached to Anchor #	Length	Scope ratio at 44' elevation		Length at 64' elevation	Scope ratio at 64' elevation	
1	1	324	16.2	1	486	16.2	1
2	2	133	6.65	1	199.5	6.65	1
3	3	150	7.5	1	225	7.5	1
4	3	113	5.65	1	169.5	5.65	1
5	3	260	13	1	390	13	1
6	3	142	7.1	1	213	7.1	1
7	4	107	5.35	1	160.5	5.35	1
8	4	236	11.8	1	354	11.8	1
9	4	137	6.85	1	205.5	6.85	1
10	5	106	5.3	1	159	5.3	1
11	5	232	11.6	1	348	11.6	1
12	5	136	6.8	1	204	6.8	1
13	6	104	5.2	1	156	5.2	1
14	6	232	11.6	1	348	11.6	1
15	6	263	13.15	1	394.5	13.15	1
16	6	111	5.55	1	166.5	5.55	1
17	7	138	6.9	1	207	6.9	1
18	7	144	7.2	1	216	7.2	1
19	7	294	14.7	1	441	14.7	1
20	8	273	13.65	1	409.5	13.65	1
21	8	310	15.5	1	465	15.5	1
22	9	80	4	1	120	4	1
23	1	246	12.3	1	369	12.3	1
24	1	248	12.4	1	372	12.4	1
25	10	174	8.7	1	261	8.7	1
26	11	72	3.6	1	108	3.6	1
27	11	98	4.9	1	147	4.9	1
28	12	71	3.55	1	106.5	3.55	1
29	12	96	4.8	1	144	4.8	1
30	13	90	4.5	1	135	4.5	1
31	13	90	4.5	1	135	4.5	1
32	14	90	4.5	1	135	4.5	1
33	14	103	5.15	1	154.5	5.15	1
34	15	110	5.5	1	165	5.5	1
35	16	190	9.5	1	285	9.5	1
36	16	90	4.5	1	135	4.5	1
37	17	218	10.9	1	327	10.9	1
38	24	303	15.15	1	454.5	15.15	1
39	26	298	14.9	1	447	14.9	1
40	28	296	14.8	1	444	14.8	1
41	31	275	13.75	1	412.5	13.75	1

42	31	281	14.05	1	421.5	14.05	1
43	43	334	16.7	1	501	16.7	1
44	10	104	5.2	1	156	5.2	1
45	20	87	4.35	1	130.5	4.35	1
46	21	192	9.6	1	288	9.6	1
47	20	74	3.7	1	111	3.7	1
48	21	191	9.55	1	286.5	9.55	1
49	21	81	4.05	1	121.5	4.05	1
50	19	40	2	1	60	2	1
51	19	55	2.75	1	82.5	2.75	1
52	18	77	3.85	1	115.5	3.85	1
53	17	182	9.1	1	273	9.1	1
54	31	215	10.75	1	322.5	10.75	1
55	17	175	8.75	1	262.5	8.75	1
56	33	92	4.6	1	138	4.6	1
57	34	70	3.5	1	105	3.5	1
58	34	117	5.85	1	175.5	5.85	1
59	22	81	4.05	1	121.5	4.05	1
60	23	74	3.7	1	111	3.7	1
61	22	186	9.3	1	279	9.3	1
62	25	35	1.75	1	52.5	1.75	1
63	25	128	6.4	1	192	6.4	1
64	25	95	4.75	1	142.5	4.75	1
65	27	88	4.4	1	132	4.4	1
66	27	42	2.1	1	63	2.1	1
67	27	114	5.7	1	171	5.7	1
68	27	91	4.55	1	136.5	4.55	1
69	28	281	14.05	1	421.5	14.05	1
70	29	88	4.4	1	132	4.4	1
71	29	54	2.7	1	81	2.7	1
72	30	130	6.5	1	195	6.5	1
73	30	124	6.2	1	186	6.2	1
74	29	111	5.55	1	166.5	5.55	1
75	32	84	4.2	1	126	4.2	1
76	32	122	6.1	1	183	6.1	1
77	32	98	4.9	1	147	4.9	1
78	29	162	8.1	1	243	8.1	1
79	32	108	5.4	1	162	5.4	1
80	33	201	10.05	1	301.5	10.05	1
81	32	108	5.4	1	162	5.4	1
82	43	229	11.45	1	343.5	11.45	1
83	35	270	13.5	1	405	13.5	1
84	33	115	5.75	1	172.5	5.75	1
85	42	130	6.5	1	195	6.5	1
86	41	126	6.3	1	189	6.3	1
87	41	144	7.2	1	216	7.2	1
88	40	130	6.5	1	195	6.5	1

89	40	130	6.5	1	195	6.5	1
90	39	130	6.5	1	195	6.5	1
91	39	130	6.5	1	195	6.5	1
92	38	128	6.4	1	192	6.4	1
93	38	126	6.3	1	189	6.3	1
94	37	100	5	1	150	5	1
95	37	167	8.35	1	250.5	8.35	1
96	36	130	6.5	1	195	6.5	1
97	36	104	5.2	1	156	5.2	1
98	35	82	4.1	1	123	4.1	1
99	26	281	14.05	1	421.5	14.05	1
100	24	292	14.6	1	438	14.6	1
		15099			22648.5		

Attachment C

Current anchor configured with 12 ea. 55 gallon drums

Dry
weight
55 gallons / 7.48 = 7.35 cubic feet
Cubic feet X 145 lbs. concrete = 1066.18 pounds

Wet weight
Dry 1066.18
weight
less displacement- 7.35 cf X 8.34 lbs. 61.32
Wet weight per drum 1004.85

Wet weight of 12 drums 12058.24

Concrete block

7.35 cf X 12 88.24 cubic feet
88.24 cubic feet / 27 = 3.27 cubic yards

Attachment D

Chatfield cost comparison- move existing anchors
vs. place new concrete blocks

Move existing 33 underwater anchors

	Qty.	Unit	Price	Extension
Barge w/operator		4 hrs	$250.00	$1,000.00
Labor		6 hrs	$79.00	$474.00
Diver		2 hrs	$125.40	$250.80
Total per anchor				$1,724.80
Total 33 anchors				$56,918.40
Contingency 20%				$11,383.68
Total				$68,302.08

Replace existing 33 underwater anchors

Set forms	2 hrs	$79.00	$158.00
concrete	3.3 yds	$125.00	$412.50
Barge w/operator	1 hrs	$250.00	$250.00
Labor	2 hrs	$79.00	$158.00
Total per anchor			$978.50
Total 33 anchors			$32,290.50
Contingency 20%			$6,458.10
Total			$38,748.60

Replace 10 buried anchors (underwater, can't be moved)

Set forms	2 hrs	$79.00	$158.00
concrete	3.3 yds	$125.00	$412.50
Backhoe w/operator	3 hrs	135	$405.00
Total per anchor			$975.50
Total 10 anchors			$9,755.00
Contingency 20%			$1,951.00
Total			$11,706.00

Total move cost	$80,008.08
Total replace cost	$50,454.60

Attachment E
Chatfield marina- cost of breakwater winch platforms

Price quotations from D&M Wire Rope, Grand Junction, CO

Description	Quantity	Unit	Unit Cost	Total Cost
5/8" IWRC	ft	1200	$1.00	$1,200.00
Cable ends	ea	4	$10.50	$42.00
Freight	lump	1	$500.00	$500.00
Reel charge	ea	2	$40.00	$80.00
				$0.00
				$1,822.00
HM24 winch w/wide drum	ea	4	$2,240.00	$8,960.00
Freight	lump	1	$650.00	$650.00
				$9,610.00
Construct floatation platform	lump	4	$3,280.00	$13,120.00
Form and place new anchors	ea	4	$1,528.93	$6,115.72
Total				$26,507.72
Contingency- 20%				$5,301.54
Total				$31,809.26

June 1, 2009

Reallocation issues for Chatfield Marina

Mitigation of the marina facility is a very complex issue as is mitigation of numerous other areas in the State Park. The same public use criteria and uncertainty exists for the marina as identified at the swim beach in the EDAW report on page 3-6. An in-kind mitigation plan could result in higher development costs and potentially higher annual maintenance costs. Looking at redevelopment of marina operations brings into question multiple issues involving both access and operations. Major issues are listed below with in-depth discussions following for each one.

The marina has been 28 years in development and refinement to achieve a smooth, viable operation. It will be almost impossible to achieve across the board in-kind replacement, but we endeavor to achieve parity through give and take negotiations and planning. Many minor and unforeseen problems will be facing the marina as the process evolves and a contingency must be reserved for those problems.

Major issues that we foresee at this time are:

1. Main parking lot elevation and proximity to the marina, dedication to marina customers and inclusion of additional parking for group picnic areas. 10 year flood protection issues

The main parking lot of the marina was constructed by the marina with private funds. The paving of the lot was done by the State several years later as part of an agreement reached with the Marina. Additional parking lots were made available by the State to handle day use picnic areas near the marina. The parking lot was briefly underwater during each of the 10 year flood events. At that water level, there was an open water exposure to the west as the main lake level was joined. Wave action was minimized by the numerous trees on the shore. Prolonged exposure along that shore with no trees for protection would pose a structural threat to the marina. Raised protection in that area should be included.

2. Final location of marina building and subsequent reconstruction:

There is an on-going history regarding the marina building. The existing structure was approved for relocation to the shore to an elevation of 5433 in order to improve access and function as well as stabilize the flotation. It was the plan to have the building out of the water permanently except for 10 year flood events. The relocation was to be achieved by adding 2-3 feet of flood water to the reservoir under controlled conditions to allow the building to be floated in place over a concrete slab and then slowly lowered into place as steel braces were added under the building. This water control was approved by the Corps. and was to be coordinated with the marina staff. This high and dry location would reverse the water absorption in the floats under the building rendering the flotation more than stable enough to re-float during any future 10 year flood events, but not permanently. This approval was closely followed by the start of serious talks regarding a reallocation at Chatfield. The storing of more water at Chatfield removed the viability of a dry shoreline location at elevation 5433 along with the method of moving the building into place. The shoreline move was put on hold and temporary flotation added to the

marina building to let the reallocation talks play out.

In 2000-2003 the drought emergency hit Colorado and the discussion quickly went from high water to no water. The building with the deeper draft caused by the temporary flotation was now at risk for catastrophic grounding due to low water. Some of the temporary flotation was removed to get by. The 2003 March blizzard saved us all and we are now back to quandary "A", the store needs to be moved to the shore for logistics and stability. The problem now is that the 5433 plan has no viability for either of the reallocation scenarios. The only solution with higher water levels appears to be a new platform with flotation for 10 year flood events and a new structure at a higher elevation. The exact location needs to be selected to meet all the needed criteria: access both from the shore and from the water to equal satisfaction.

3. Shoreline stabilization around marina to accommodate new water levels

The proposed elevation changes for the marina cove will be very challenging for the shoreline surrounding the marina. Rip-rap is extremely problematic in this application. The quiet waters in front of the marina are a haven for air-born trash, dead fish and public refuse. All this trash migrates to the shore and is trapped on the beach, rip-rap or whatever is on the shore. Maintenance is by hand and very tedious, even now on the sandy beach and would be potentially prohibitive if the shore stabilizing material is not designed with this in mind.

4. Access to/from the marina building for customers, vendors, employees as well as utilities and maintenance

Continuing with the #2 discussion, all electrical hookups, sewers, lift stations, telephone lines, water lines, etc. must be replaced Vendor deliveries, customer and employee usage and access must be coordinated with any new marina building location. ADA considerations must always be considered.

5. Location of trash dumpsters with access for service trucks and marina employees handling trash carts from the marina

The marina funded and built an area near the boat launch turn around loop for trash receptacles that allow employees to easily take trash to shore from the marina and transfer to the dumpster. . A mid-way path was developed accessing the dumpster location. This same path facilitates access to the existing land based restroom. All these facilities will be inundated and will need to be replaced.

6. Location of marina on-shore fenced service area and dedicated employee parking

The marina funded and built an on-shore fenced service area at the parking lot level for service equipment and supplies as well as an asphalt parking lot for dedicated employee parking. This service area will be inundated and must be relocated and replaced.

7. Location of main electrical transformers

Two main transformers now feed the marina property. Both were placed on a hill built by the marina that was above the 10 year flood level. One of these transformers belongs to the marina and the other belongs to the State. With the transformers at this level, the marina and some of the State's facilities are able to remain operational during the 10 year flood events. This 10 year flood buffer will be lost at elevation 5444 and must be mitigated, including all underground marine cable which is rated for underwater service.

8. Anchor cable holding capacity and winch adjustment issues along with dead weight anchor replacement and maintenance

The Chatfield marina concession contract was selected because of the proximity to a vast and growing population, a very small water level fluctuation, and a permanent minimum pool. The anchor system at Chatfield has been developed for minimal labor for adjustment, with most anchors needing no adjustment during a normal operating year. No anchors at all need adjustment during the busy summer boating season. A new anchoring system must be developed to handle the larger fluctuations with the reallocation. The study done by Aramark addressed the maintenance of a constant scope with existing anchors which would maintain holding capacity at deeper levels. However, the question of increased anchor adjustment was not addressed and the issue needs to be revisited. New anchors would need to be installed with in-kind holding capacity to the current system as well as consideration for no interference with deep draft boats during low water periods. The marina is currently changing all existing anchors to screw-type anchors and starting to recover all of the concrete barrel anchors.. Unfortunately, the barge and installation system for this screw anchor system cannot handle the increased depths of the reallocation.

9. Harbor wind, wave, and ice shift protection during normal operating water levels as well as 10 year flood events

Land masses fully enclose the marina harbor on 3 sides with the open area on the lake side of the marina protected by a large 18 foot wide dock with a full tire breakwater in front of it. This configuration fully protects the marina against wind, wave and ice shift events. The reconstruction must maintain this full protection, in kind.

10. Floating breakwater anchor and adjustment issues

Unlike the Lake Powell breakwater example, the marina breakwater is much lighter weight and cannot be anchored at the 2 ends only. The main marina floating breakwater has 18 cables anchoring it in place and the smaller, secondary tire breakwater at the west of the harbor has 2 cables. The secondary breakwater is in place for 10 year flood events only. The multiple cables assure minimal loss of breakwater anchoring and positioning should there be a cable failure. There is currently no adjustment needed for the breakwater anchor cables during normal operating periods. Also, currently, there is no means for breakwater anchor cable adjustment. Increased depths and fluctuation would require winch platforms at all 20 cables.

11. Harbor excavation and subsequent logistics for relocation and protection of the entire floating portion of the marina facilities

The harbor excavation to an elevation of 5412 to accommodate operation of boats at water elevation 5417 is a product of the 2000-2003 drought years. It also facilitates sand and gravel material recovery to raise parking lots, land masses and other facilities above the proposed new high water plus freeboard elevation. The marina is currently anchored by 99 cables and will need to be moved out of the way and safely re-anchored in a temporary location to clear the harbor for the excavation. This process will be very time and labor intensive and will interrupt the marina business for a significant length of time. Ice shift is a tremendous force on the marina docks which may greatly limit winter work as well as interfere with where the marina can be put during construction.

12. Rental boat operations including customer access and navigation issues, employee access, and beach based operations

The rental boat operation currently utilizes an easy access group of docks that are close to the gas facility. This allows employee costs to be shared. The rental boats are set to come and go well outside of the marina leased slip area for the safety and peace of mind of both renter and private boat docking customer. Approximately ½ of the rental fleet operates from the sandy shore in front of the marina.

13. Public restroom proximity for customer access including day use boater, marina patron and snack bar patrons,

The public restroom, if land based, must be located at a distance equal to the distance now experienced for day use boats, marina dock patrons, and marina snack bar patrons. The snack bar is currently operating on a health department variance for the restroom requirement based on the closeness and ease of access to the present public land based restroom. The floating restroom in the marina is reserved for Seagulls Restaurant customers only and is limited in capacity because of the size of the sewage handling pumps and lift station basin.

14. Gas dispensing operations including supplier, customer and employee access

The on-water gasoline facility at the marina has critical placement issues. The gas barge and floating dispensers must remain close to the road for delivery truck access. Simultaneously, it must have easy access for boats to docks at a selection of 4 different fueling locations and then facilitate easy exit in order to meet peak season volume demands. An employee must be in attendance to monitor the fueling operation and initiate safety and anti-pollution procedures as needed. This employee is shared with the rental operation. The gas dock facility also houses the marina pump out equipment and needs to be accessible to the largest boats with the deepest drafts. The marine pump out facility discharges to the marina store lift station at this time. An alternate sewage handling scheme would need to be addressed when the store is relocated.

15. Facility beautification for on-going customer appeal

The marina is touted to be one of the nicest facilities in one of the prettiest settings in the western United States. Beautification of the marina area after reconstruction is extremely important and

definitely part of the mitigation process.

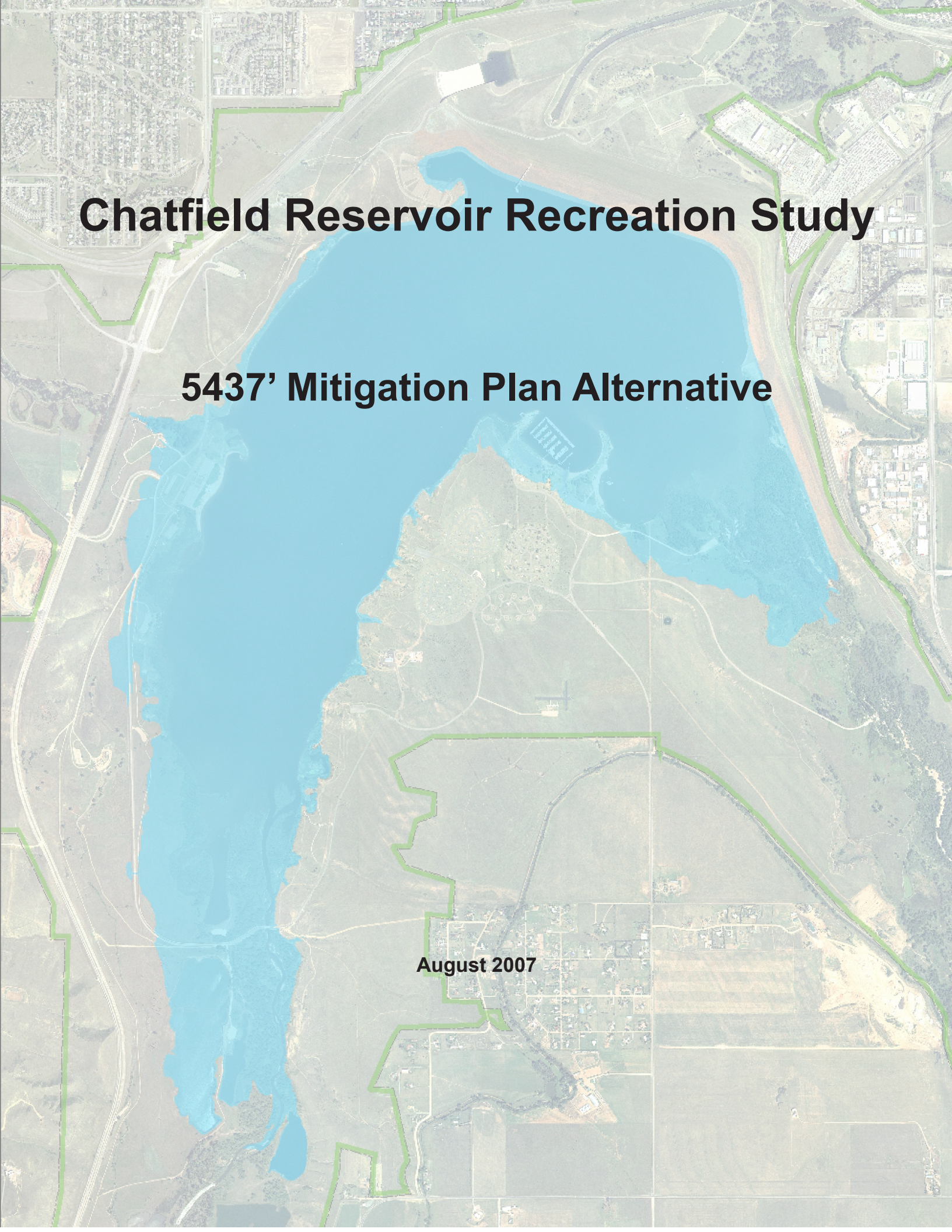
16. Economic impact of the construction and reallocation process. (Already touched on briefly by EDAW)

This is an obvious area for detailed discussion which will be visited many more times in the future.

While this is just an overview, it represents an example of the complexity at hand in regard to the marina. Revisiting the issues should be in depth and often.

Linda and Roger Perry,
Chatfield Marina, Inc.

Appendix 5. 5437' Reservoir Elevation Alternative



Chatfield Reservoir Recreation Study

5437’ Mitigation Plan Alternative

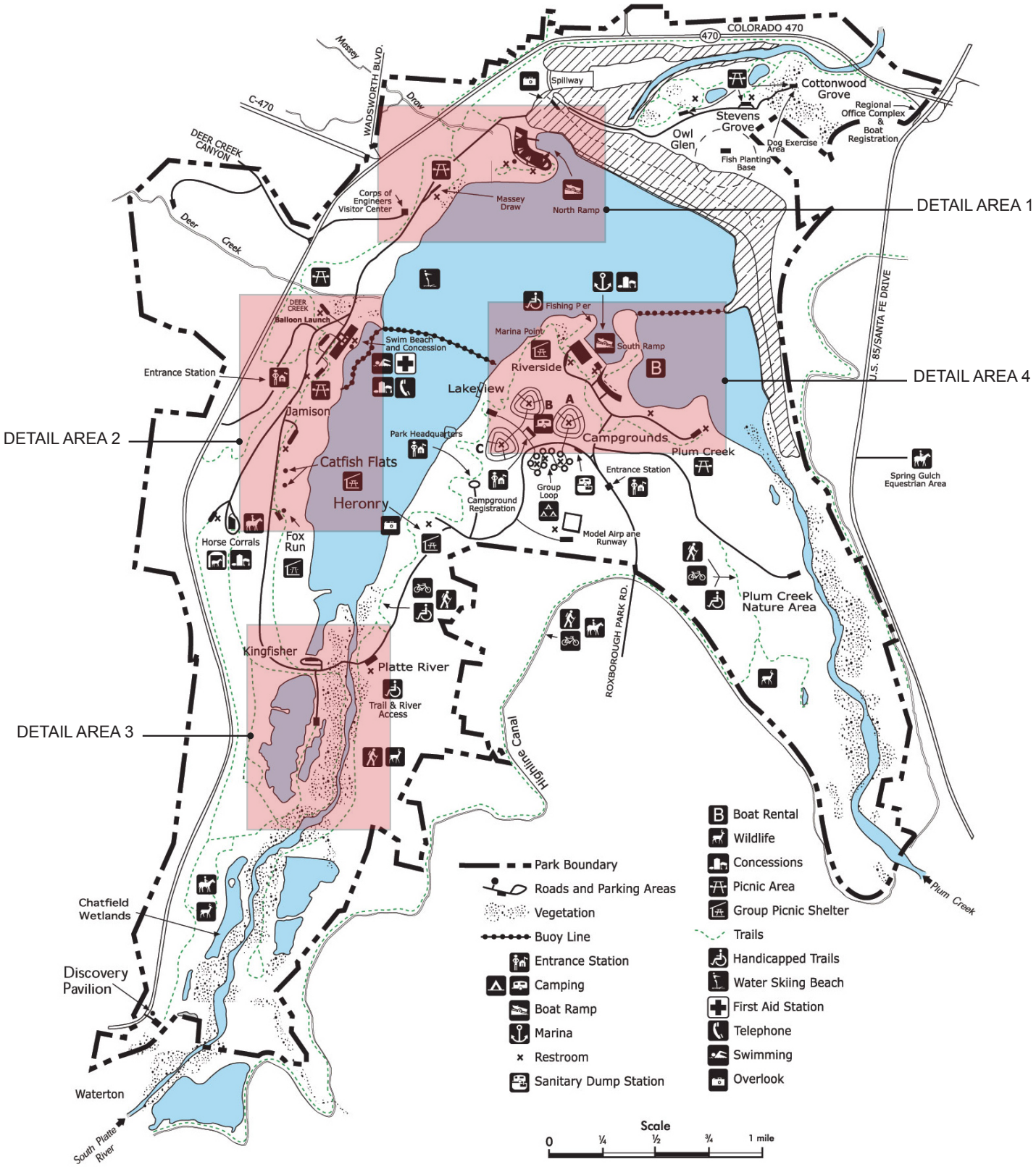
August 2007

Chatfield Reservoir Recreation Study

5437’ Mitigation Plan Alternative

August 2007

5437’ Mitigation Plan Alternative



Map 5.1

5437' Alternative

This section describes facility effects and conceptual designs for the relocation and redevelopment of park facilities that would be impacted by an alternative that would raise the water level of Chatfield Reservoir to 5437', or approximately 7' lower than the alternative that was previously described. Impacts to park facilities and programs were based on a future high pool water elevation of 5437', with an additional buffer of 2 vertical feet to account for wave action and provide a margin of safety. Major facilities, such as buildings and main roadways, which had to be relocated or redeveloped, were located above the additional buffer of two vertical feet, at a 5439' elevation.

Any facilities or use areas that fell below, or close to, elevation 5439' were evaluated for replacement or adjustment. In some cases, an existing parking area or boat ramp would only need to be partially modified to accommodate the future water level.

An important assumption that guided the conceptual design effort was that no facility or program area would loose any capacity or functionality as the result of relocation or modification. Put another way, the mitigation plan provides for in kind replacement of facilities affected by higher water levels. Design and development of replaced facilities would be completed under current building codes, Colorado State Parks building requirements, and to meet American Disability Act (ADA) requirements for public facilities.

It must be emphasized that the mitigation plan reflects a conceptual level of design. More detailed design will be required to address site-specific conditions and other design factors. Among these, is the need to base the design on final reservoir operations modeling so that facility locations and features reflect the actual drawdown conditions that are anticipated after the reallocation project is further refined.

Costs for implementing the recreation mitigation plan are presented in pages A-28 - A-48. A key assumption in developing the mitigation plan is that fill material will be available from on site sources and that this material can be obtained from locations below the high water line.

During preliminary stages of this study, design alternatives were considered at varying levels of detail. Following review and discussion with Colorado State Parks and other study participants, a preferred concept was identified for each major use area. Only the preferred concept is presented in this report.

Affected Recreational Use Areas and Facilities

The discussion that follows focuses on the affected use areas and provides an area-by-area description of what facilities would have to be relocated or redeveloped. Areas that would not be influenced, such as the campgrounds, are not considered in this discussion. The areas that would be affected include the following:

- North Ramp/Massey Draw
- Swim Beach Area
- Kingfisher/Platte River Areas
- Marina Area
- Plum Creek Area

North Ramp/Massey Draw

This is the only formal boat launch area on the west side of the reservoir. It includes two ramps, paved parking and circulation areas, and a variety of support facilities. The area also includes a series of picnic shelters. Table 5.1 provides a complete listing of facilities in the area, noting which of these would be influenced by a water level increase to 5437'.

Map 5.2 is an aerial photo depicting the area with the 5439' water elevation shown. As can be seen in the photo, the two existing boat ramps would be inundated. Remaining areas, including most of the parking, the picnic shelters and circulation roads, would remain above the normal high water line.

NORTH RAMP			
ITEM	**UNIT**	**UNIT QTY**	**INUNDATION AT ELEVATION 5439**
PARKING AREA			
Asphalt	SF	400,000	NO
BOAT RAMPS			
Concrete	SF	16,800	Yes
Docks	ITEM	4	NA
TRAILS			
Concrete Trails	SF	60,000	NO
ARCHITECTURE			
Restroom Building -West	SF	485	NO
Restroom Building	SF	485	NO
Day Use Shelter	SF	168	NO
Day Use Shelter - west	SF	168	NO
Information kiosk	ITEM	2	NO
FURNITURE			
Picnic Tables	ITEM	32	NO
Benches	ITEM	1	NO
Water fountain	ITEM	4	NO
Dumpsters	ITEM	3	NO
Trash Receptacles	ITEM	7	NO
Bollards	ITEM	4	NO
Grills	ITEM	8	NO
Regulatory Signs	ITEM	46	NO
UTILITIES			
Water Hydrants	ITEM	2	NO
Lift Station	ITEM	2	NO
Telephone	ITEM	1	NO
ELECTRICAL			
Transformers	ITEM	1	NO
Light poles	ITEM	26	NO

Table 5.1 North Ramp Inventory

Freeboard Elevation - 5439
High Pool Elevation - 5437
Low Pool Elevation - 5428
Sidewalks, Bike Paths, Trails
State Park Boundary
Aerial Photograph: May 1999
7/23/07

EDAW | AECOM

Chatfield Reservoir
Recreational Mitigation Study
NORTH BOAT RAMP
Map 5.2

Massey Draw is another popular use area located in the vicinity of the north ramps. Facilities located in this area are also listed in Table 5.2 and depicted in Map 5.3. The beach area, including a volleyball court and horseshoe pits, would be inundated at 5439'.

MASSEY DRAW			
ITEM	**UNIT**	**UNIT QTY**	**INUNDATION AT ELEVATION 5439**
PARKING AREA			
Gravel	SF	34,000	NO
Wheel Stops	ITEM	34	NO
TRAILS			
Asphalt Trails	SF	9,304	50%
ARCHITECTURE			
Restroom Building	SF	250	NO
FURNITURE			
Picnic Tables	ITEM	8	YES
Benches	ITEM	3	YES
Dumpsters	ITEM	2	NO
Trash Receptacles	ITEM	3	YES
Grills	ITEM	8	YES
Regulatory Signs	ITEM	12	NO
Fencing	LF	487	NO
RECREATIONAL FACILITIES			
Beach Volleyball Court	ITEM	1	YES
Horseshoe Pits	ITEM	2	YES

Table 5.2 Massey Draw Inventory

Freeboard Elevation - 5439
High Pool Elevation - 5437
Low Pool Elevation - 5428
Sidewalks, Bike Paths, Trails
State Park Boundary
Aerial Photograph: May 1999
7/23/07

EDAW | AECOM

Chatfield Reservoir
Recreational Mitigation Study
MASSEY DRAW AREA
Map 5.3

Swim Beach Area

This is a key use area that is heavily visited. Swimming is the most popular visitor activity at Chatfield State Park. Major development has occurred in this area, including large parking areas, a swim beach with graded slopes and sand, and a wide variety of support facilities such as restrooms, concession buildings, and others. The area also includes an extensive network of walkways and trails. Facilities are itemized in Table 5.3.

As shown in Map 5.4, most of this area would be inundated at a water elevation of 5437' and would have to be relocated.

The swim beach area also includes the Deer Creek Area with its balloon launch facilities and day use sites. The balloon launch area is very popular and hosts an annual balloon festival that attracts thousands of visitors. Facilities in this area are listed in Table 5.3 and depicted in Map 5.4. An increase in water elevation to 5437' would not inundate the area.

SWIM BEACH			
ITEM	**UNIT**	**UNIT QTY**	**INUNDATION AT ELEVATION 5439**
PARKING AREA			
Asphalt	SF	238,000	75%
Wheel Stops	ITEM	274	75%
TRAILS			
Concrete Trails	SF	5,112	YES
ARCHITECTURE			
Swim beach Shower/Restroom Building	SF	1,275	YES
Swim beach Concession Building	SF	650	YES
Swim beach First Aid Station	SF	510	YES
Information kiosk	ITEM	2	YES
FURNITURE			
Picnic Tables	ITEM	12	YES
Benches	ITEM	7	YES
Water fountain	ITEM	2	YES
Dumpsters	ITEM	4	YES
Trash Receptacles	ITEM	10	YES
Bollards	ITEM	6	YES
Grills	ITEM	8	YES
Regulatory Signs	ITEM	17	YES
Fencing	LF	929	YES
RECREATIONAL FACILITIES			
Lawn	SF	80,000	YES
Beach Volleyball Court	ITEM	0	YES
Horse Shoe Pits	ITEM	0	YES
Sand	CY		
UTILITIES			
Water Hydrants	ITEM	2	YES
Lift Station	ITEM	1	YES
Telephone	ITEM	2	YES
ELECTRICAL			
Light poles	ITEM	1	YES
Electrical Transformer	ITEM	2	YES

Table 5.3 Swim Beach Inventory

Freeboard Elevation - 5439
High Pool Elevation - 5437
Low Pool Elevation - 5428
Sidewalks, Bike Paths, Trails
State Park Boundary
Aerial Photograph: May 1999
7/23/07
EDAW | AECOM

Chatfield Reservoir
Recreational Mitigation Study
SWIM BEACH AREA
Map 5.4

Another use area in this vicinity is Eagle Cove, which is located just north of Deer Creek. The limited facilities in this area are listed in Table 5.4 and illustrated in Map 5.4. All of the facilities in this area would have to be relocated.

EAGLE COVE			
ITEM	**UNIT**	**UNIT QTY**	**INUNDATION AT ELEVATION 5439**
PARKING AREA			
Wheel Stops	ITEM	29	YES
Gravel	SF	13,000	50%
ARCHITECTURE			
Portable restroom	ITEM	1	YES
FURNITURE			
Dumpsters	ITEM	1	YES
Trash Receptacles	ITEM	1	YES
Regulatory Signs	ITEM	2	YES
Fencing	LF	84	YES
DEER CREEK			
PARKING AREA			
Asphalt	SF	26,000	NO
Gravel staging road	SF	34,000	NO
Wheel Stops	ITEM	28	NO
TRAILS			
Concrete Trails	SF	18,000	NO
Foot bridge	LF	15'	NO
ARCHITECTURE			
Restroom Building	SF	485	NO
Information kiosk	ITEM	1	NO
FURNITURE			
Picnic Tables	ITEM	12	NO
Benches	ITEM	1	NO
Water fountain	ITEM	2	NO
Dumpsters	ITEM	1	NO
Bollards	ITEM	4	NO
Trash Receptacles	ITEM	2	NO
Grills	ITEM	11	NO
Regulatory Signs	ITEM	5	NO
Wind Sock	ITEM	1	NO
LANDSCAPE			
Landscaped Island	SF	3,421	NO
Decorative stone retaining wall	LF	54	NO
UTILITIES			
Water Hydrants	ITEM	1	NO
ELECTRICAL			
Transformers	ITEM	1	NO

Table 5.4 Eagle Cove and Deer Creek Inventory

Jamison/Catfish Flats/Fox Run Group Use Areas

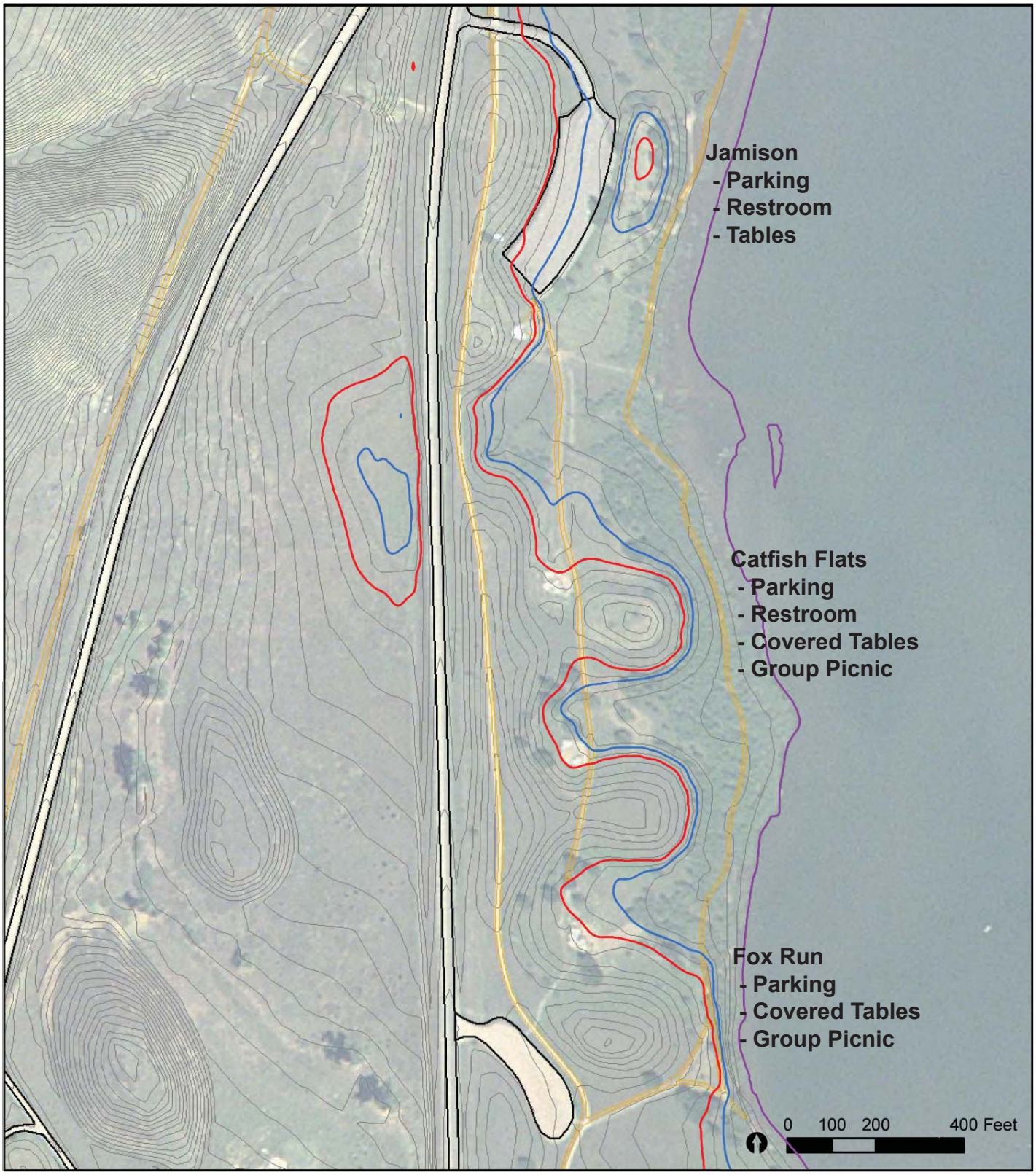
These areas consist of a series of group use areas that include picnic shelters, restrooms, parking, and related facilities. A complete listing of facilities is provided in Tables 5.5-7. Map 5.5 depicts the relationship between these facilities and a water elevation of 5437'. At this water elevation, some of these facilities would be inundated and they would have to be redeveloped at another location. Portions of the trail system would also have to be redeveloped.

JAMISON			
ITEM	UNIT	UNIT QTY	INUNDATION AT ELEVATION 5439
PARKING AREA			
Asphalt	SF	41,500	50%
Wheel Stops	ITEM	61	YES
TRAILS			
Concrete Trails	SF	30,000	YES
ARCHITECTURE			
Jamison Restroom	SF	485	YES
FURNITURE			
Picnic Tables	ITEM	4	YES
Benches	ITEM	1	YES
Water fountain	ITEM	2	YES
Dumpsters	ITEM	1	YES
Trash Receptacles	ITEM	1	YES
Grills	ITEM	4	YES
Regulatory Signs	ITEM	9	YES
UTILITIES			
Lift Station	ITEM	1	YES
ELECTRICAL			
Electrical Transformer	ITEM	1	YES

Table 5.5 Jamison Inventory

CATFISH FLATS			
ITEM	UNIT	UNIT QTY	INUNDATION AT ELEVATION 5439
PARKING AREA			
Asphalt	SF	61,000	NO
Wheel Stops	ITEM	79	NO
TRAILS			
Concrete Trails	SF	18,392	YES
ARCHITECTURE			
Restroom Building	SF	485	NO
Group Picnic Area 1 (North)			
Walls	LF	135	NO
Group Shelters	SF	1,512	NO
Gravel Pavement	SF	3,450	NO
Picnic Tables	ITEM	10	NO
Electrical Hookup	ITEM	1	NO
Group Picnic Area 2 (South)			
Walls	LF	135	YES
Group Shelters	SF	756	YES
Gravel Pavement	SF	3,000	NO
Picnic Tables	ITEM	8	YES
Electrical Hookup	ITEM	1	NO
FURNITURE			
Picnic Tables	ITEM	5	YES
Benches	ITEM	1	YES
Water fountain	ITEM	2	YES
Dumpsters	ITEM	1	YES
Trash receptacles	ITEM	1	YES
Regulatory Signs	ITEM	9	YES
UTILITIES			
Water Hydrants	ITEM	3	NO
Lift Station	ITEM	1	NO
ELECTRICAL			
Electrical Transformer	ITEM	1	NO

Table 5.6 Catfish Flats Inventory



Freeboard Elevation - 5439
High Pool Elevation - 5437
Low Pool Elevation - 5428
Sidewalks, Bike Paths, Trails
State Park Boundary
Aerial Photograph: May 1999
7/23/07
EDAW | AECOM

Chatfield Reservoir

Recreational Mitigation Study
JAMISON/ CATFISH FLATS/
FOX RUN GROUP USE AREAS

Map 5.5

FOX RUN			
ITEM	UNIT	UNIT QTY	INUNDATION AT ELEVATION 5439
PARKING AREA			
Gravel	SF	31,000	NO
TRAILS			
Concrete Trails	SF	47,688	50%
ARCHITECTURE			
Portable Restrooms	ITEM	2	NO
Group Picnic Area			
Walls	LF	135	YES
Group Shelters	SF	1,512	YES
Gravel Pavement	SF	3,450	YES
Picnic Tables	ITEM	8	YES
Electrical Hookup	YES/NO	No	
FURNITURE			
Picnic Tables	ITEM	0	YES
Benches	ITEM	0	YES
Water fountain	ITEM	0	YES
Dumpsters	ITEM	1	YES
Trash receptacles	ITEM	2	YES
Regulatory Signs	ITEM	5	50%
Fencing	LF	716	NO
RECREATIONAL FACILITIES			
Beach Volleyball Court	ITEM	1	YES
Horse Shoe Pits	ITEM	2	YES
UTILITIES			
Water Hydrants	ITEM	1	NO

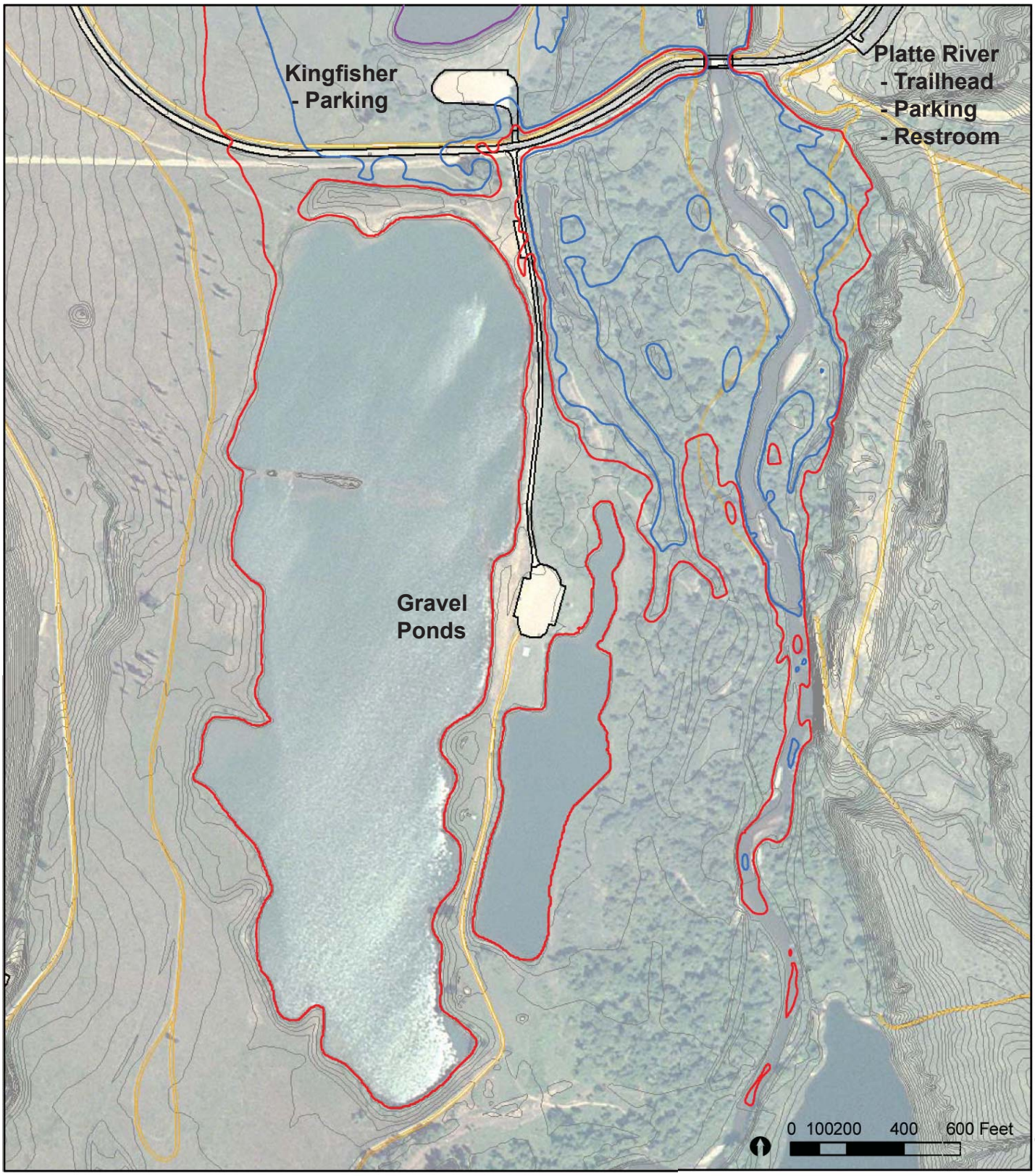
Table 5.7 Fox Run Inventory

Kingfisher/Platte River Areas

A variety of uses occur at this end of the reservoir, especially around the gravel ponds that lie between the reservoir and the main park road that leads to the campground/marina area. The large gravel pond is used by dog training clubs, non-motorized boaters, fishermen, and others. There are relatively few developed facilities in this area, primarily parking areas and trails. These are listed in Table 5.8. Map 5.6 shows the area in detail and highlights the fact that all existing facilities in this area would be inundated at 5439'.

KINGFISHER AREA			
ITEM	**UNIT**	**UNIT QTY**	**INUNDATION AT ELEVATION 5439**
PARKING AREA			
Gravel	SF	38,000	YES
Wheel Stops	ITEM	28	YES
FURNITURE			
Portable Restrooms	ITEM	1	YES
Dumpsters	ITEM	1	YES
Trash receptacles	ITEM	1	YES
Regulatory Signs	ITEM	3	YES
Fencing	LF	375	YES
GRAVEL PONDS			
PARKING AREA			
Gravel	SF	86,500	YES
Wheel Stops	ITEM	38	YS
ARCHITECTURE			
Portable Restrooms	ITEM	1	YES
FURNITURE			
Picnic Tables	ITEM	4	YES
Dumpsters	ITEM	1	YES
Trash receptacles	ITEM	1	YES
Regulatory Signs	ITEM	18	YES
Fencing	LF	596	YES
PLATTE RIVER			
PARKING AREA			
Asphalt	SF	19,000	NO
Wheel Stops	ITEM	87	NO
TRAILS			
Concrete Trails	SF	9,000	50%
ARCHITECTURE			
Restroom Building	SF	250	NO
FURNITURE			
Picnic Tables	ITEM	0	NO
Benches	ITEM	2	NO
Dumpsters	ITEM	0	NO
Trash receptacles	ITEM	2	NO
Regulatory Signs	ITEM	7	NO
Fencing	LF	743	NO
UTILITIES			
Water Hydrants	ITEM	1	NO

Table 5.8 Kingfisher Area



Freeboard Elevation - 5439
High Pool Elevation - 5437
Low Pool Elevation - 5428
Sidewalks, Bike Paths, Trails
State Park Boundary
Aerial Photograph: May 1999
7/23/07
EDAW | AECOM

Chatfield Reservoir
Recreational Mitigation Study
KINGFISHER/ PLATTE RIVER AREAS
Map 5.6

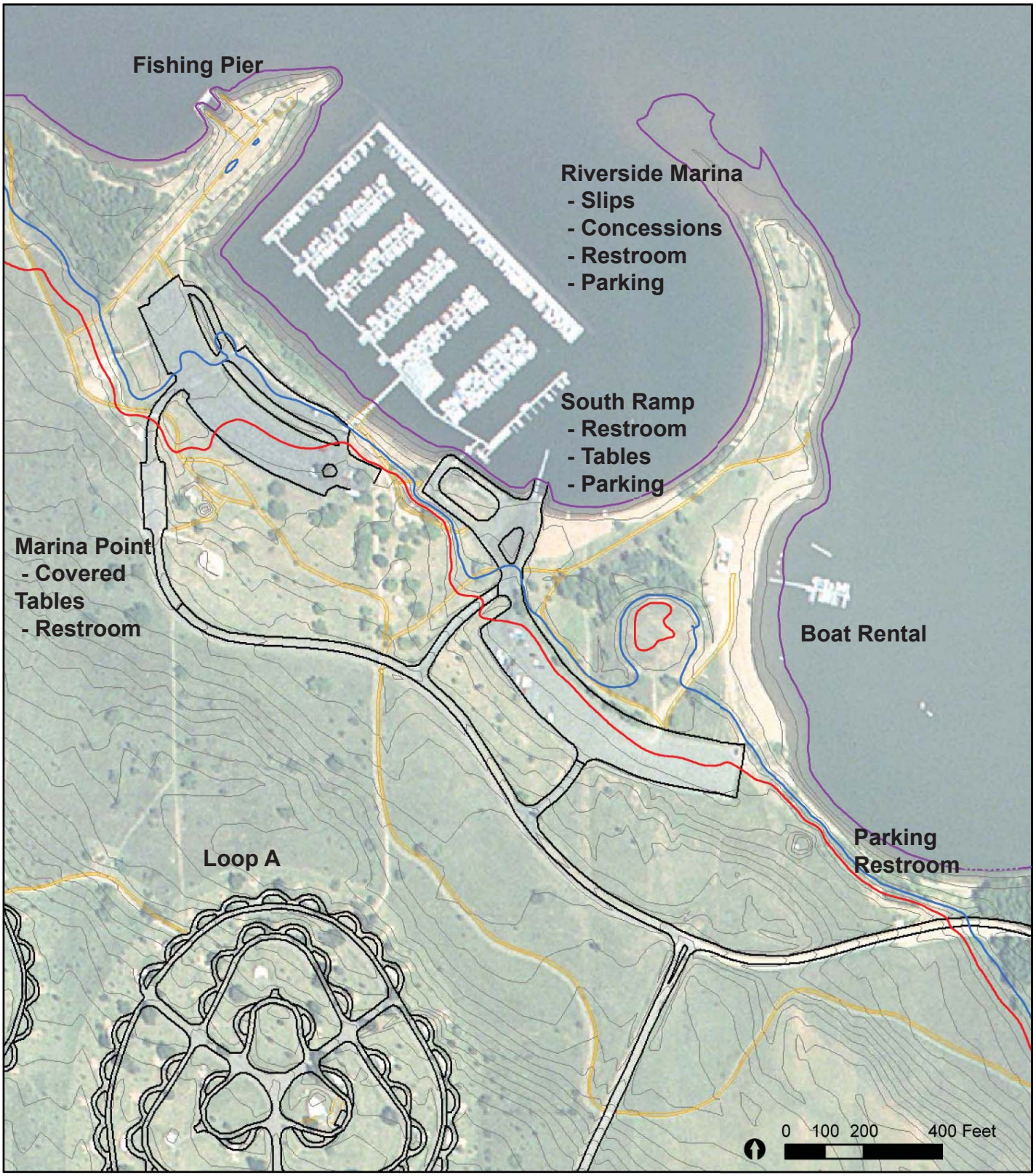
Marina Area

This is a major use area that has been extensively developed. The area includes the marina itself, a fishing pier, extensive paved parking areas, a boat ramp, group picnic sites, and an extensive network of walkways and trails. A detailed list of facilties is provided in Table 5.9.

Map 5.7 shows the area in detail and depicts the 5439' water elevation. Nearly all of the existing facilities in this area would be affected by an increase in the water level to 5439' and most of the area would have to be redeveloped.

RIVERSIDE MARINA AREA			
ITEM	**UNIT**	**UNIT QTY**	**INUNDATION AT ELEVATION 5439**
Boat Ramp - concrete	SF	4,750	YES
PARKING AREA			
Asphalt	SF	148,000	50%
Wheel Stops	ITEM	36	50%
TRAILS			
Concrete Trails	SF	7,000	YES
ARCHITECTURE			
Concessions Building	SF	656	YES
Shower/Restroom Building	SF	656	YES
Day Use Shelter	SF	168	YES
Information Kiosk	ITEM	1	YES
Group Picnic Area			
Walls	LF	135	YES
Group Shelters	SF	2,268	YES
Concrete Pavement	SF	5,088	YES
Picnic Tables	ITEM	10	YES
Electrical Hookups	ITEM	1	YES
FURNITURE			
Picnic Tables	ITEM	10	YES
Benches	ITEM	1	YES
Water Fountain	ITEM	1	YES
Dumpsters	ITEM	4	YES
Trash Receptacles	ITEM	4	YES
Regulatory Signs	ITEM	37	YES
RECREATION FACILITIES			
Beach Volleyball Court	ITEM	1	YES
Horseshoe Pits	ITEM	2	YES
UTILITIES			
Water Hydrants	ITEM	2	YES
ELECTRICAL			
Light Poles	ITEM	1	YES
WATER-BASED OPERATIONS			
Concessions Building	SF	4,500	RELOCATION
Riverside Marina Slips			RELOCATION
Boat Rental Slips/Dock			RELOCATION

Table 5.9 Marina Area Inventory



Freeboard Elevation - 5439
High Pool Elevation - 5437
Low Pool Elevation - 5428
Sidewalks, Bike Paths, Trails
State Park Boundary
Aerial Photograph: May 1999
7/23/07

EDAW | AECOM

Chatfield Reservoir
Recreational Mitigation Study
MARINA AREA
Map 5.7

MARINA POINT			
ITEM	**UNIT**	**UNIT QTY**	**INUNDATION AT ELEVATION 5444**
PARKING AREA			
Asphalt	SF	136,500	YES
Wheel Stops	ITEM	200	YES
TRAILS			
Concrete Trails	SF	14,000	YES
ARCHITECTURE			
Restroom Building	SF	485	YES
ADA Fishing Pier	SF	2,000	YES
Information kiosk	ITEM	0	
Group Picnic Area			
Walls	LF	135	YES
Group Shelters	SF	2,268	YES
Concrete Pavement	SF	5,088	YES
Picnic Tables	ITEM	10	YES
Electrical Hookup	YES/NO	yes	
FURNITURE			
Picnic Tables	ITEM	0	YES
Benches	ITEM	1	YES
Water fountain	ITEM	2	YES
Dumpsters	ITEM	1	YES
Trash Receptacles	ITEM	2	YES
Regulatory Signs	ITEM	9	YES
Fencing	LF	138	YES
RECREATIONAL FACILITIES			
Beach Volleyball Court	ITEM	1	YES
Horse Shoe Pits	ITEM	2	YES
UTILITIES			
Water Hydrants	ITEM	1	YES
ELECTRICAL			
Light poles	ITEM	3	YES
Electrical Transformer	ITEM	2	YES
ROXBOROUGH COVE			
PARKING AREA			
Gravel	SF	7,950	YES
ARCHITECTURE			
Vault Restroom Building	SF	250	YES
FURNITURE			
Picnic Tables	ITEM	5	YES
Trash Receptacles	ITEM	3	YES
Regulatory Signs	ITEM	8	YES
UTILITIES			
Lift Station	ITEM	1	YES
ELECTRICAL			
Electrical Transformer	ITEM	1	YES

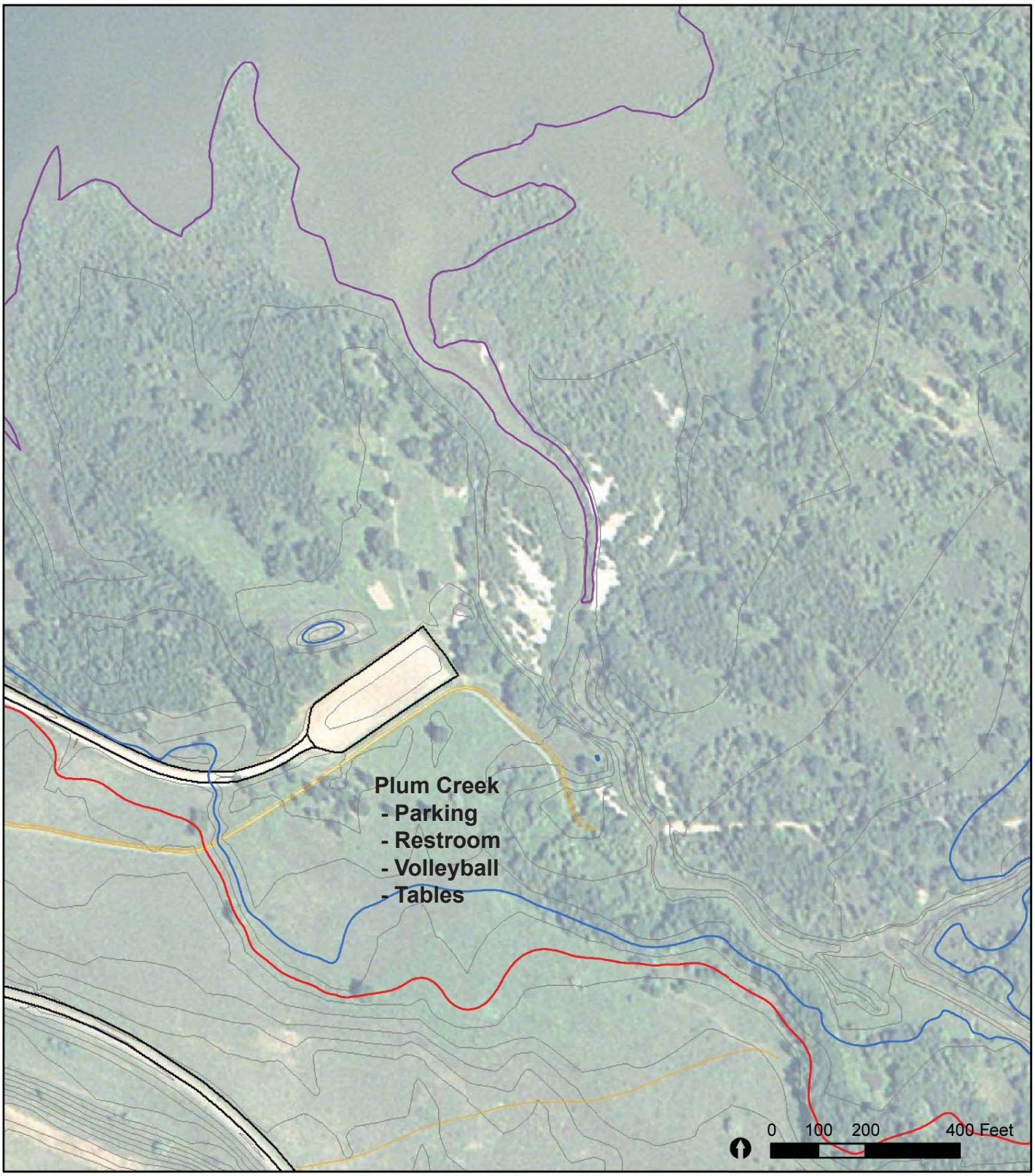
Table 5.10 Marina Point & Roxborough Cove Inventory

Plum Creek Area

This area serves as a trailhead and also has a day use area with tables, a rest-room, and parking. A list of facilities in this area is provided in Table 5.11. Map 5.8 shows the current area layout.

PLUM CREEK AREA			
ITEM	**UNIT**	**UNIT QTY**	**INUNDATION AT ELEVATION 5444**
PARKING AREA			
Gravel	SF	35,000	YES
TRAILS			
Concrete Trails	SF	7,200	YES
ARCHITECTURE			
Restroom Building	SF	485	YES
FURNITURE			
Picnic Tables	ITEM	11	YES
Benches	ITEM	1	YES
Dumpsters	ITEM	1	YES
Regulatory Signs	ITEM	2	YES
Fencing	LF	697	YES
RECREATIONAL			
Volleyball	ITEM	1	YES

Table 5.11 Plum Creek Inventory



Freeboard Elevation - 5439
High Pool Elevation - 5437
Low Pool Elevation - 5428
Sidewalks, Bike Paths, Trails
State Park Boundary
Aerial Photograph: May 1999
7/23/07

EDAW | AECOM

Chatfield Reservoir
Recreational Mitigation Study
PLUM CREEK
Map 5.8

Mitigation Plan

This section provides an area by area discussion and conceptual designs for replacing facilities affected by an increase in water level to 5437'. Cost estimates for facility replacement are presented at the back of this section.

North Boat Ramp

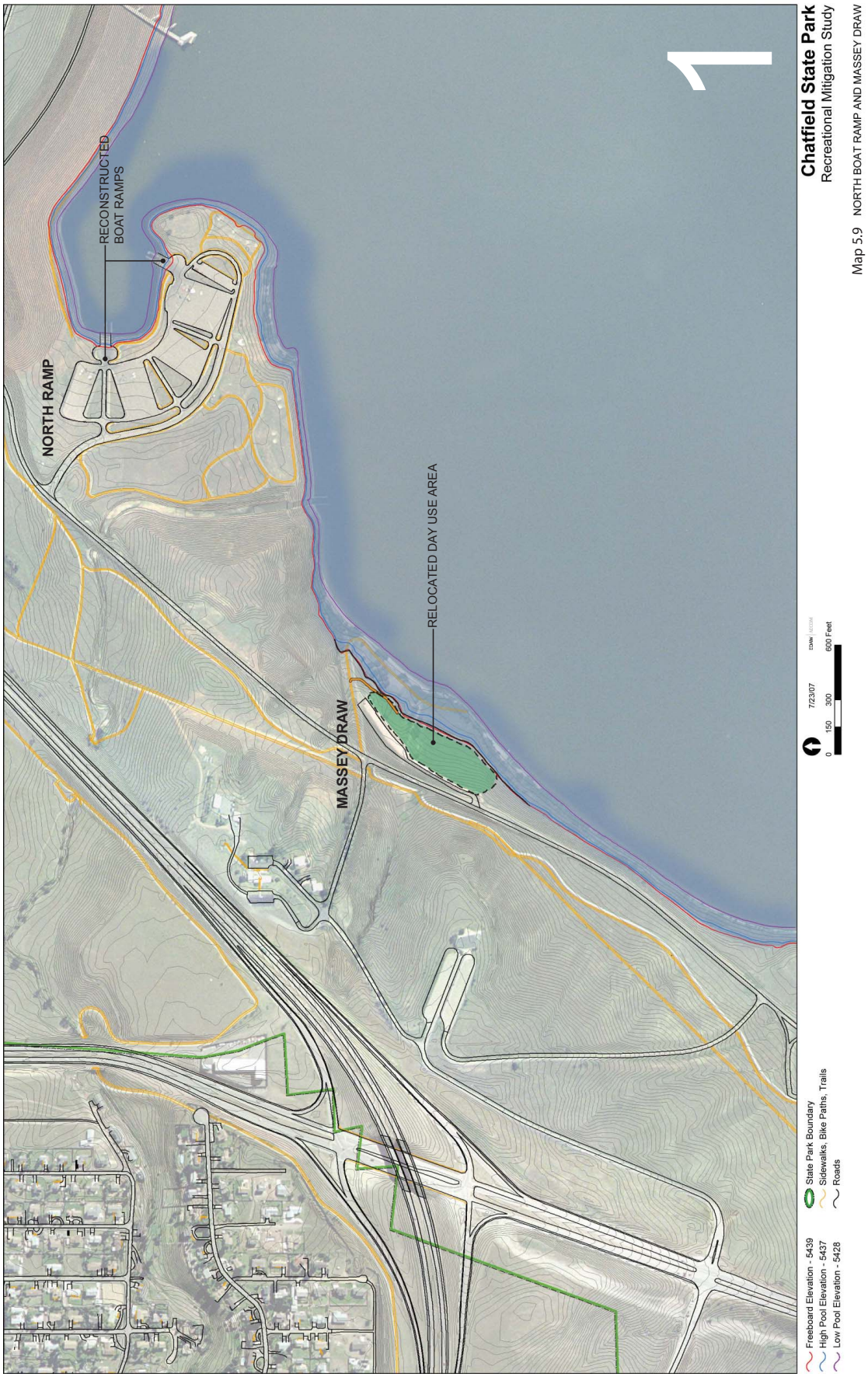
- High Pool Elevation, 5437', results in partial inundation of this facility, with ramps becoming inoperable.
- Facilities affected are the boat ramps.
- Boat ramps would be constructed to extend to the elevation of the existing ramps in order to operate at low water levels. The gradient (slope) on the new ramps would be reduced.

The resulting concept is illustrated in Map 5.9.

Massey Draw Day Use Area

- Raising the water level to a High Pool Elevation of 5437' severely reduces the recreation capacity of this area but does not inundate the existing parking area and restrooms.
- Mitigation to this area would include creating a usable recreational area in a location closer to large parking area, with a similar amount of usable area that currently exists. Existing beach volleyball and horseshoe pits would be rebuilt. Furniture can be stored and relocated to future area.

The resulting mitigation concept is illustrated in Map 5.9.


NORTH RAMP
RECONSTRUCTED BOAT RAMPS
MASSEY DRAW
RELOCATED DAY USE AREA
1
Chatfield State Park
Recreational Mitigation Study
Map 5.9 NORTH BOAT RAMP AND MASSEY DRAW
7/23/07
0 150 300 600 Feet
State Park Boundary
Sidewalks, Bike Paths, Trails
Roads
Freeboard Elevation - 5439
High Pool Elevation - 5437
Low Pool Elevation - 5428

Swim Beach and Vicinity

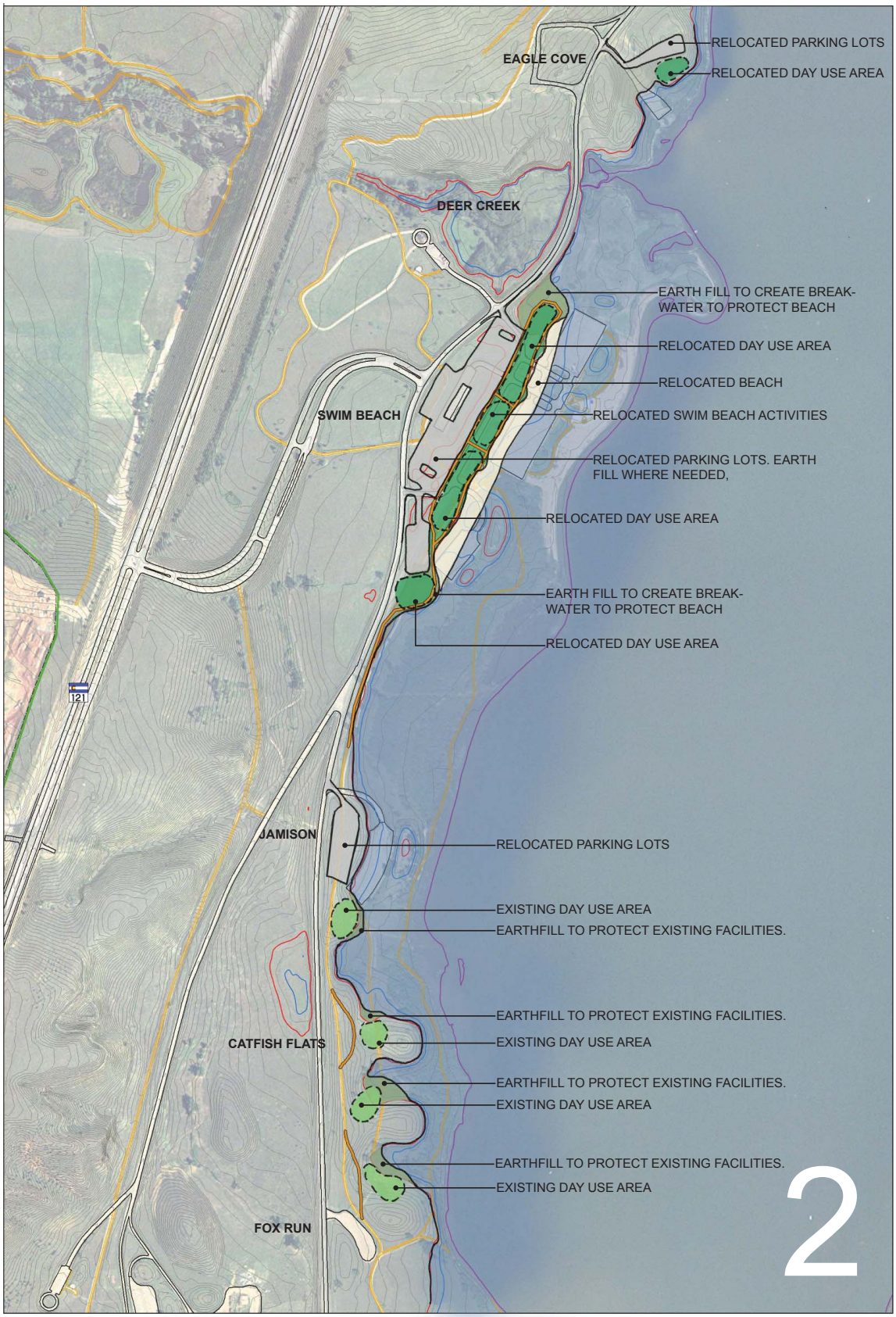
Impacts in the Swim Beach vicinity are the most substantial of all facilities located along the shoreline. The majority of the Swim Beach site and associated parking area would be inundated and a number of other facilities would also be affected. The mitigation concept is described below and is illustrated in Map 5.10.

Swim Beach

- Swim beach area is completely inundated at 5437'.
- The facility would be relocated to the west of the current facility. A swim beach area of similar quality to that presently existing could be developed at this location.
- In order to construct a beach, the existing facility will need to be demolished and excavated. Sand will need to be saved and also imported to create the new beach environment. The excavated material will assist in filling low areas that would be inundated at 5439' to ensure these areas are usable at this proposed elevation.
- The current buildings, lawn area, and recreation facilities would be rebuilt in the new location.

Jamison Picnic Area/ Catfish Flats & Fox Run Group Picnic Areas

The existing parking at Jamison and the day use area at Catfish Flats would be partially inundated. New parking facilities at Jamison would be developed closer to the road. These areas, which currently don't directly relate to the water, would have an improved setting, each situated on an elevated site overlooking the reservoir. Earthfill would be used to raise each area to create this close relationship with the water.


EAGLE COVE
RELOCATED PARKING LOTS
RELOCATED DAY USE AREA
DEER CREEK
EARTH FILL TO CREATE BREAK-WATER TO PROTECT BEACH
RELOCATED DAY USE AREA
RELOCATED BEACH
SWIM BEACH
RELOCATED SWIM BEACH ACTIVITIES
RELOCATED PARKING LOTS. EARTH FILL WHERE NEEDED,
RELOCATED DAY USE AREA
EARTH FILL TO CREATE BREAK-WATER TO PROTECT BEACH
RELOCATED DAY USE AREA
121
JAMISON
RELOCATED PARKING LOTS
EXISTING DAY USE AREA
EARTHFILL TO PROTECT EXISTING FACILITIES.
EARTHFILL TO PROTECT EXISTING FACILITIES.
CATFISH FLATS
EXISTING DAY USE AREA
EARTHFILL TO PROTECT EXISTING FACILITIES.
EXISTING DAY USE AREA
EARTHFILL TO PROTECT EXISTING FACILITIES.
EXISTING DAY USE AREA
FOX RUN
2
Freeboard Elevation - 5439
High Pool Elevation - 5437
Low Pool Elevation - 5428
State Park Boundary
Sidewalks, Bike Paths, Trails
Roads
7/23/07
0 150 300 600 Feet
Chatfield State Park
Recreational Mitigation Study
SWIM BEACH AREA
JAMISON/CATFISH FLATS/
FOX RUN GROUP USE AREAS

Map 5.10

Kingfisher Day Use Area

- Kingfisher area is entirely inundated at 5437'.
- A new parking area would be developed along the shoreline at a site west of its current location. The area would include a portable restroom and similar facilities to those that exist at the current site.
- Existing trail connections would be redeveloped above the high waterline to provide similar recreational opportunities.

Gravel Ponds

- The gravel ponds are not inundated at 5437'; however, the road to the parking area is partially inundated. This road would be raised with earth fill and rebuilt.


RELOCATED DAY USE AREA
RELOCATED PARKING LOTS
KINGFISHER
REBUILD BRIDGE AT A HIGHER ELEVATION
EARTH FILL AND REBUILD ROAD
PROPOSED CULVERT
EARTH FILL AND REBUILD ROAD
EXISTING DAY USE AREA
3
Freeboard Elevation - 5439
High Pool Elevation - 5437
Low Pool Elevation - 5428
State Park Boundary
Sidewalks, Bike Paths, Trails
Roads
7/23/07
0 150 300 600 Feet
Chatfield State Park
Recreational Mitigation Study
KINGFISHER/ PLATTE RIVER AREAS
Map 5.11

Marina Area

There is significantly higher topography in the Marina area, which somewhat limits impacts to shoreline facilities. The mitigation concept for this area is shown in Map 5.12.

Marina Point/South Ramp

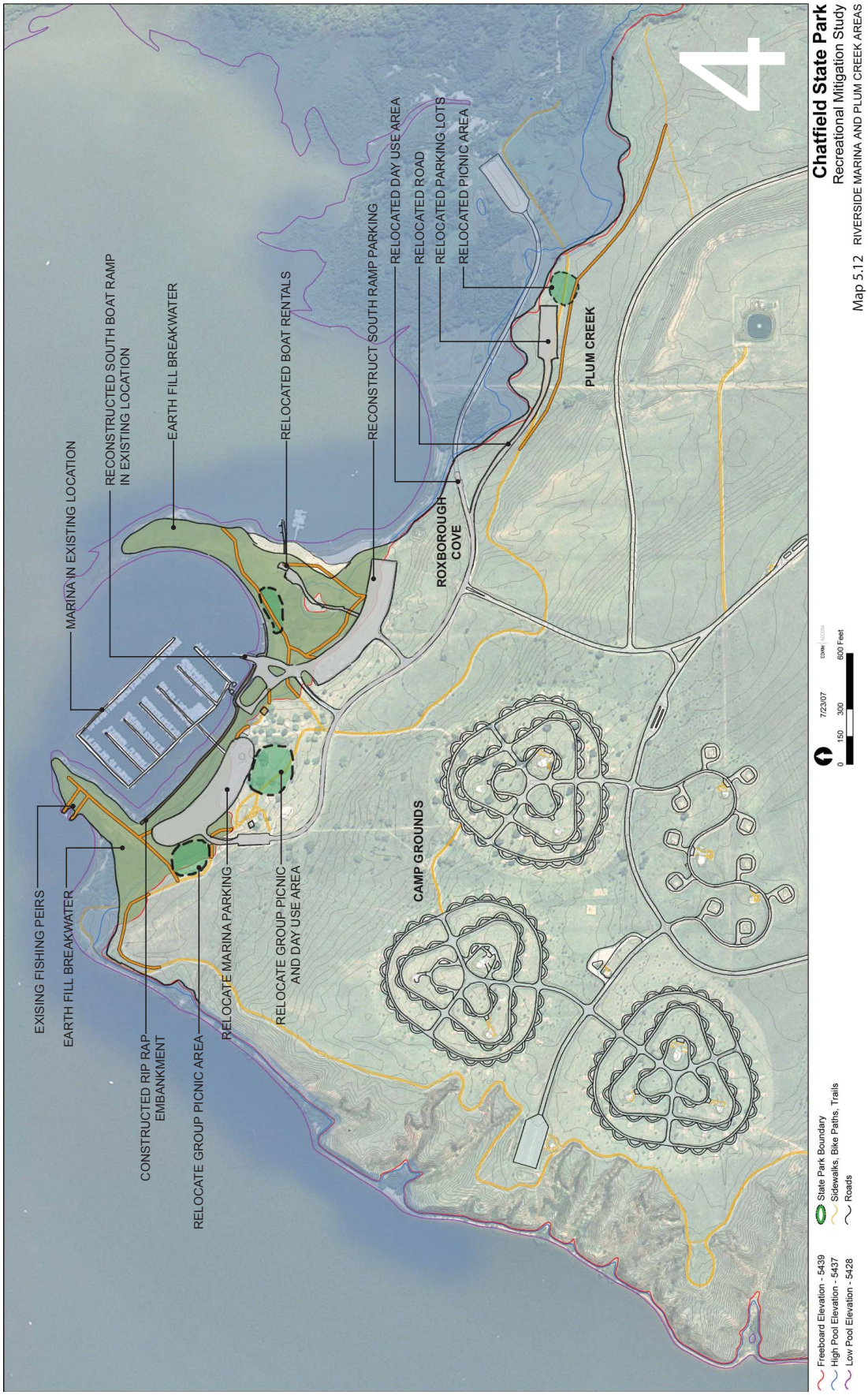
- Marina Point facilities are impacted at the proposed water elevation. While most of the facilities are above the 5439, most of the parking area falls below that elevation. The result is a relocation of the parking which will effer the group day use area, volleyball and horseshoe pits. These facilities, which weren't inundated, will also have to be relocated.
- Significant earthwork in the form of earth fill needs to be accomplished to ensure future use in this area. The current facilities would be located on an elevated surface. This fill placement would include construction of new breakwaters similar to those that currently exist that would function at water elevation 5437'.
- Due to the possibility of increased water fluctuations, the marina store and restaurant were relocated to the shoreline. The marina would be developed on a flotation system for the designed for the occurrence of water above the 5437' elevation.
- The parking areas, day use shelters, group use area and recreational areas associated with the South Ramp would also be mostly inundated at 5439'. These areas would be rebuilt on fill areas in the same general location where they currently exist.
- The boat rental site would need to be raised and relocated slightly to the West.
- Trails and walkways in the inundated area would be rebuilt.
- There is a distinct possibility that construction activities in the marina vicinity will result in a loss of revenue to the marina operator and state park. The window when construction could occur without significantly affecting marina operations is relatively short, extending from November through March. This is probably not enough time to complete the required reconstruction, particularly if adverse weather conditions are encountered. Potential economic effects resulting from this disruption are discussed in Chapter 4 of the main report.

Roxborough Cove Day Use Area

- This small yet popular day use area is entirely inundated at water elevation 5439'. It would be relocated to a new location close to its existing one. Easy access to the shoreline, which it currently enjoys, would remain as the draw card for this area.

Plum Creek Day Use Area and Trailhead

- Plum Creek Day Use Area is entirely inundated at the proposed water elevation.
- The area would be relocated to the southern edge of the reservoir. The recreational facilities would be replaced at this location and a new restroom would be built.
- The Plum Creek trailhead would be relocated to this area and inundated trail segments replaced.


4
EXISING FISHING PEIRS
EARTH FILL BREAKWATER
CONSTRUCTED RIP RAP EMBANKMENT
RELOCATE GROUP PICNIC AREA
RELOCATE MARINA PARKING
RELOCATE GROUP PICNIC AND DAY USE AREA
MARINA IN EXISTING LOCATION
RECONSTRUCTED SOUTH BOAT RAMP IN EXISTING LOCATION
EARTH FILL BREAKWATER
RELOCATED BOAT RENTALS
RECONSTRUCT SOUTH RAMP PARKING
RELOCATED DAY USE AREA
RELOCATED ROAD
RELOCATED PARKING LOTS
RELOCATED PICNIC AREA
ROXBOROUGH COVE
PLUM CREEK
CAMP GROUNDS
Freeboard Elevation - 5439
High Pool Elevation - 5437
Low Pool Elevation - 5428
State Park Boundary
Sidewalks, Bike Paths, Trails
Roads
0 150 300 600 Feet
7/23/07
Chatfield State Park
Recreational Mitigation Study
Map 5.12 RIVERSIDE MARINA AND PLUM CREEK AREAS

5437' Alternative Mitigation Cost Estimate

CONCEPT PLAN COST ESTIMATE — **EDAW, Inc.** **July 31, 2007**

ITEM	UNIT	UNIT QTY	UNIT COST 2007	EXTENDED COST	NOTES
NORTH RAMP					
DEMOLITION					
Clear and Grub	SF	43560	$0.05	$2,265	Strip site and remove grasses and shrubs
Remove Existing Asphalt Trail	SF	0	$0.78	$0	Asphalt trail to picnic shelters
Remove Existing Concrete trails	SF	200	$0.78	$156	
Remove Existing Asphalt Pavement	SF	32000	$0.78	$24,960	
Remove Existing Traffic Signs	ALLOW	1	$1,040.00	$1,040	Store and reinstall at future locations
Remove & Relocate Existing Shade Structure	EA	0	$10,400.00	$0	
Remove and relocate Information Kiosk Signage	EA	2	$1,040.00	$2,080	
Remove & Relocate Existing Light Poles	EA	2	$3,120.00	$6,240	
CATEGORY SUBTOTAL				**$36,741**	
EARTHWORK					
Bulk Embankment	CY	3556	$2.08	$7,396	(Fill = 47000 CY)
Excavation and Hauling	CY	3556	$3.12	$11,095	Includes excavation and 1 mile haul to construction site
Rock Removal	Allow	1	$10,400.00	$10,400	Allowance for unclassified rock removal
Topsoil - Strip , Stockpile and Spread	CY	3556	$4.16	$14,793	Assumes 6" depth removal at surfaced areas, stockpile, and spread all new landscape areas
Fine Grading	SF	335500	$0.03	$10,468	Assumes 120% of all paved and landscape areas
CATEGORY SUBTOTAL				**$54,152**	
ROADS AND PARKING					
Asphalt	SF	20000	$2.31	$46,139	Includes new asphalt for regraded area
Striping	ALLOW	1	$5,200.00	$5,200	
Curb and gutter	LF	1000	$8.32	$8,320	
CATEGORY SUBTOTAL				**$59,659**	
BOAT RAMPS					
Concrete	SF	29000	$8.32	$241,280	Includes all launch lanes (8), plus extension for operations at 5417. 8 inch stamped concrete.
Rip Rap Erosion Protection	Allow	1	$15,600.00	$15,600	At Boat ramp
Docks	ITEM	4	$1,040.00	$4,160	Assume reuse of docks. Salvage, store &relocate.
CATEGORY SUBTOTAL				**$261,040**	
TRAILS					
Concrete Trails	SF	0	$3.64	$0	Assumes 6' wide path
Asphalt Trail	SF	0	$2.08	$0	Assumes 6' wide path
CATEGORY SUBTOTAL				**$0**	
STRUCTURES					
Restroom Building -West	SF	0	$234.00	$0	Remain in place - not affected
Restroom Building	SF	0	$234.00	$0	Remain in place - not affected
Day Use Shelter	EA	0	$0.00	$0	Cost to relocate accounted for in demolition division
Day Use Shelter Concrete Pad	SF	0	$3.64	$0	Assume 1000 S.F. per Shelter
Information kiosk	EA	0	$0.00	$0	Cost to relocate accounted for in demolition division
CATEGORY SUBTOTAL				**$0**	
FURNISHINGS					
Picnic Tables	EA	0	$104.00	$0	Store and relocate picnic tables under relocated shelters
Benches	ITEM	0	$0.00	$0	not affected
Water fountain	ITEM	0	$0.00	$0	2 attached per restroom building - Not affected
Dumpsters	ITEM	0	$780.00	$0	Store and reinstall at future locations
Trash Receptacles	ITEM	0	$52.00	$0	Store and reinstall at future locations
Bollards	ITEM	0	$156.00	$0	gate posts at launch ramps - store and relocate in existing location
Grills	ITEM	0	$78.00	$0	Store and reinstall at future locations
Regulatory Signs	ALLOW	0	$208.00	$0	Cost accounted for in demolition division
CATEGORY SUBTOTAL				**$0**	
UTILITIES					
Water Line	LF	0	$7.80	$0	1" diameter water distribution line. Assumed length for relocated hydrants
Sanitary Sewer Lateral Line	LF	0	$12.48	$0	4" diameter sewer lateral
Sanitary Sewer Manhole	EA	0	$3,640.00	$0	

ITEM	UNIT	UNIT QTY	UNIT COST	EXTENDED COST	NOTES
Water Hydrants	EA	0	$1,560.00	$0	Frost Free Hydrant Includes connection to local piping and trenching costs
Lift Station	ITEM	0	$15,600.00	$0	not affected
Storm Water Inlets	EA	0	$3,640.00	$0	Storm Water inlet includes new piping and trenching
Storm Water Oil Separator Inlets	EA	0	$10,400.00	$0	Storm Water inlet for oil separation includes new piping and trenching
Storm Water Pipe	LF	0	$24.96	$0	Storm Water pipe - 12" diameter
CATEGORY SUBTOTAL				**$0**	
ELECTRICAL and TELECOMMUNICATIONS					
Electric Distribution Line	LF	200	$15.60	$3,120	Underground electric distribution in conduit. Allow for lighting and misc. electric.
Telephone Line	EA	0	$2,600.00	$0	Underground telephone wire in conduit
Transformers	ITEM	0	$0.00	$0	75 KVA
Light poles	ITEM	2	$0.00	$0	Cost accounted for in demolition division
CATEGORY SUBTOTAL				**$3,120**	
LANDSCAPE					
Seeding Dryland Grasses	SF	1000	$0.10	$104	Allowance. Drilled seeding disturbed areas.
Straw Mulch	SF	1000	$0.03	$31	Crimped over seeded areas
Hydro Mulch	SF	0	$0.05	$0	Spray mulch over seeded areas
Deciduous Trees	EA	0	$312.00	$0	Allowance. 2.5 " Caliper
Evergreen Trees	EA	0	$364.00	$0	Allowance. 8' Average Height
Shrubs	EA	0	$26.00	$0	Allowance. 5 Gallon Shrubs
CATEGORY SUBTOTAL				**$135**	
IRRIGATION					
Point of Connection	EA	0	$2,080.00	$0	Connection to water main, vacuum breaker,
Spray Irrigation	SF	0	$1.04	$0	Large Radius Pop Up Heads
Bubbler Irrigation	Per Plant	0	$78.00	$0	Bubbler at Trees and Shrubs
CATEGORY SUBTOTAL				**$0**	
SUBTOTAL				**$414,847**	
CONTRACTORS GENERAL CONDITIONS	**12%**			**$49,782**	
CONCEPT PLAN CONTINGENCY	**25%**			**$103,712**	
GRAND TOTAL				**$568,340**	

ITEM	UNIT	UNIT QTY	UNIT COST	EXTENDED COST	NOTES
MASSEY DRAW					
DEMOLITION					
Clear and Grub	SF	43560	$0.05	$2,265	Strip site and remove grasses and shrubs
Remove Existing Asphalt Trail	SF	5600	$0.78	$4,368	Asphalt trail to picnic shelters
Remove horse shoe boards and store	EA	4	$208.00	$832	
Remove volleyball court posts and store	EA	2	$208.00	$416	
CATEGORY SUBTOTAL				**$7,881**	
EARTHWORK					
Bulk Embankment	CY	1500	$2.08	$3,120	
Excavation and Hauling	CY	1500	$3.12	$4,680	
Rock Removal	Allow	1	$10,400.00	$10,400	Allowance for unclassified rock removal
Topsoil - Strip , Stockpile and Spread	CY	880	$4.16	$3,661	Assumes 6" depth removal at surfaced areas, stockpile, and spread all new landscape areas
Fine Grading	SF	1000	$0.05	$52	Assumes all paved and landscape areas
CATEGORY SUBTOTAL				**$21,913**	
PARKING AREA					
Gravel	SF	34000	$0.00	$0	not affected
Wheel Stops	ITEM	34	$0.00	$0	not affected
CATEGORY SUBTOTAL				**$0**	
TRAILS					
Concrete Trails	SF	0	$3.64	$0	
Asphalt Trail	SF	5600	$2.08	$11,648	Assumes 6' wide path
CATEGORY SUBTOTAL				**$11,648**	
ARCHITECTURE					
Restroom Building	SF	0	$234.00	$0	not affected
CATEGORY SUBTOTAL				**$0**	
FURNITURE					
Picnic Tables	ITEM	8	$104.00	$832	Remove, store and relocate tables
Benches	ITEM	2	$104.00	$208	Remove, store and relocate 2 timber benches
Dumpsters	ITEM	0	$780.00	$0	not affected
Trash Receptacles	ITEM	3	$52.00	$156	Remove, store and relocate.
Grills	ITEM	0	$78.00	$0	not affected
Regulatory Signs	ITEM	0	$208.00	$0	not affected
Fencing	LF	0	$15.60	$0	not affected
CATEGORY SUBTOTAL				**$1,196**	
RECREATIONAL FACILITIES					
Beach Volleyball Court	ITEM	1	$5,200.00	$5,200	Includes new sand, reinstalled posts.
Horse Shoe Pits	ITEM	2	$1,040.00	$2,080	
CATEGORY SUBTOTAL				**$7,280**	
LANDSCAPE					
Seeding Dryland Grasses	SF	392040	$0.10	$40,772	Allowance - 9 acres day use area. Drilled seeding
Straw Mulch	SF	392040	$0.05	$20,386	Crimped over seeded areas
Hydro Mulch	SF	0	$0.05	$0	Spray mulch over seeded areas
Deciduous Trees	EA	75	$390.00	$29,250	Allowance. 2.5 " Caliper
Evergreen Trees	EA	25	$364.00	$9,100	Allowance. 8' Average Height
Shrubs	EA	250	$26.00	$6,500	Allowance. 5 Gallon Shrubs
CATEGORY SUBTOTAL				**$106,008**	
IRRIGATION					
Point of Connection	EA	1	$2,080.00	$2,080	Connection to water main, vacuum breaker,
Spray Irrigation	SF	0	$1.04	$0	Large Radius Pop Up Heads
Bubbler Irrigation	Per Plant	350	$78.00	$27,300	Bubbler at Trees and Shrubs
CATEGORY SUBTOTAL				**$29,380**	
SUBTOTAL				**$185,306**	
CONTRACTORS GENERAL CONDITIONS	**12%**			**$22,237**	
CONCEPT PLAN CONTINGENCY	**25%**			**$46,327**	
GRAND TOTAL				**$253,869**	

ITEM	UNIT	UNIT QTY	UNIT COST	EXTENDED COST	NOTES
EAGLE COVE					
DEMOLITION					
Clear and Grub	SF	43560	$0.05	$2,265	Strip site and remove grasses and shrubs
Remove and relocate post and cable barrier	LF	84	$10.40	$874	
Remove and relocate dumpster	EA	1	$104.00	$104	
CATEGORY SUBTOTAL				**$3,243**	
EARTHWORK					
Bulk Embankment	CY	2500	$2.08	$5,200	
Excavation and Hauling	CY	2500	$3.12	$7,800	Includes excavation and 1 mile haul to construction site
Rock Removal	Allow	1	$10,400.00	$10,400	Allowance for unclassified rock removal
Topsoil - Strip , Stockpile and Spread	CY	250	$4.16	$1,040	Assumes 6" depth removal at surfaced areas, stockpile, and spread all new landscape areas
Fine Grading	SF	40000	$0.05	$2,080	Assumes all paved and landscape areas
CATEGORY SUBTOTAL				**$26,520**	
PARKING AREA					
Wheel Stops	ITEM	29	$20.80	$603	Relocated 6"x8"x8' CCA timber
Gravel	SF	13000	$0.78	$10,140	Assume 8" depth base course = 40 SF/CY
CATEGORY SUBTOTAL				**$10,743**	
ARCHITECTURE					
Portable restroom	ITEM	1	$780.00	$780	Relocation to new location
CATEGORY SUBTOTAL				**$780**	
FURNITURE					
Dumpsters	ITEM	0	$780.00	$0	Cost accounted for in demolition division
Trash Receptacles	ITEM	1	$52.00	$52	Remove and relocate.
Regulatory Signs	EA	2	$208.00	$416	Traffic signs, warning signs, direction signs etc
Fencing	LF	84	$0.00	$0	Cost accounted for in demolition division
CATEGORY SUBTOTAL				**$468**	
LANDSCAPE					
Seeding Dryland Grasses	SF	65340	$0.10	$6,795	Drilled seeding
Straw Mulch	SF	65430	$0.05	$3,402	Crimped over seeded areas
Hydro Mulch	SF	0	$0.05	$0	Spray mulch over seeded areas
Deciduous Trees	EA	50	$390.00	$19,500	2.5 " Caliper
Evergreen Trees	EA	25	$364.00	$9,100	8' Average Height
Shrubs	EA	100	$26.00	$2,600	5 Gallon Shrubs
CATEGORY SUBTOTAL				**$41,398**	
IRRIGATION					
Point of Connection	EA	1	$2,080.00	$2,080	Connection to water main, vacuum breaker,
Spray Irrigation	SF	0	$1.04	$0	Large Radius Pop Up Heads
Bubbler Irrigation	Per Plant	175	$78.00	$13,650	Bubbler at Trees and Shrubs
CATEGORY SUBTOTAL				**$15,730**	
SUBTOTAL				**$98,882**	
CONTRACTORS GENERAL CONDITIONS	**12%**			**$11,866**	
CONCEPT PLAN CONTINGENCY	**25%**			**$24,720**	
GRAND TOTAL				**$135,468**	
~~PARK ENTRANCE STATION - DEER CREEK~~					
EXISTING AREA IS NOT DISTURBED					
~~DEER CREEK DAY USE AREA~~					
EXISTING AREA IS NOT DISTURBED					

ITEM	UNIT	UNIT QTY	UNIT COST	EXTENDED COST	NOTES
SWIM BEACH					
DEMOLITION					
Clear and Grub	SF	43560	$0.05	$2,265	Strip site and remove grasses and shrubs
Remove Existing Concrete trails	SF	12000	$0.78	$9,360	
Remove Existing Asphalt Pavement	SF	35292	$0.78	$27,528	
Remove Existing Turf	SF	50000	$0.05	$2,600	
Remove Existing Traffic Signs	ALLOW	1	$2,080.00	$2,080	Store and reinstall at future locations
Remove and relocate Information Kiosks	EA	2	$1,040.00	$2,080	
Demolish Existing Buildings	ALLOW	1	$20,800.00	$20,800	
Remove and relocate wheel stops	EA	310	$20.80	$6,448	Remove, store and relocate
Remove and store Chain Mesh Fence	LF	929	$5.20	$4,831	
Remove and relocate post and rail fence	LF	44	$20.80	$915	
CATEGORY SUBTOTAL				**$78,907**	
EARTHWORK					
Bulk Earthwork	CY	171000	$4.16	$711,360	In Place - (Cut = 765,000, Fill = 20,457 CY)
Bulk Cut	CY	765000	$2.08	$1,591,200	
Rock Removal	Allow	1	$10,400.00	$10,400	Allowance for unclassified rock removal
Excavation and Hauling	CY	0	$3.12	$0	Includes excavation and 1 mile haul to construction site
Topsoil - Strip , Stockpile and Spread	CY	6618	$4.16	$27,531	Assumes 6" depth removal at surfaced areas, stockpile, and spread all new landscape areas
Fine Grading	SF	900000	$0.05	$46,800	Assumes all paved and landscape areas + 20%
CATEGORY SUBTOTAL				**$2,387,291**	
ROADS AND PARKING					
Asphalt	SF	36000	$2.31	$83,050	
Striping	ALLOW	1	$5,200.00	$5,200	
CATEGORY SUBTOTAL				**$88,250**	
TRAILS					
Concrete Trails	SF	12000	$3.64	$43,680	Assumes 6' wide path
CATEGORY SUBTOTAL				**$43,680**	
STRUCTURES					
Swim beach Shower/Restroom Building	SF	1600	$234.00	$374,400	
Swim beach Concession Building	SF	650	$234.00	$152,100	
Swim beach First Aid Station	SF	510	$234.00	$119,340	
Information kiosk	SF	2	$0.00	$0	Cost to relocate accounted for in demolition division
Concrete Plaza	SF	7000	$3.64	$25,480	
CATEGORY SUBTOTAL				**$671,320**	
FURNISHINGS					
Picnic Tables	EA	12	$104.00	$1,248	Store and relocate picnic tables at future locations
Benches	ITEM	7	$0.00	$0	
Water fountain	ITEM	2	$0.00	$0	
Dumpsters	ITEM	4	$780.00	$3,120	Store and reinstall at future locations
Trash Receptacles	ITEM	10	$52.00	$520	Store and reinstall at future locations
Bollards	ITEM	6	$156.00	$936	store and relocate in existing location
Grills	ITEM	8	$78.00	$624	Store and reinstall at future locations
Regulatory Signs	ALLOW	0	$208.00	$0	Cost accounted for in demolition divisior
Fencing - Chain Mesh	LF	929	$10.40	$9,662	
Fencing - Post and Rail	LF	44	$0.00	$0	Cost accounted for in demolition division
CATEGORY SUBTOTAL				**$16,110**	
RECREATIONAL FACILITIES					
Beach Sand	CY	13500	$15.60	$210,600	120,000 SF assumed depth of 3' = 13500 CY
CATEGORY SUBTOTAL				**$210,600**	

ITEM	UNIT	UNIT QTY	UNIT COST	EXTENDED COST	NOTES
UTILITIES					
Water Line	LF	250	$7.80	$1,950	1" diameter water distribution line
Sanitary Sewer Lateral Line	LF	250	$12.48	$3,120	4" diameter sewer lateral
Sanitary Sewer Manhole	EA	2	$3,640.00	$7,280	
Water Hydrants	EA	2	$1,560.00	$3,120	Frost Free Hydrant Includes connection to local piping and trenching costs
Lift Station	ITEM	2	$0.00	$0	not affected
Storm Water Inlets	EA	3	$3,640.00	$10,920	Storm Water inlet includes new piping and trenching
Storm Water Oil Separator Inlets	EA	2	$10,400.00	$20,800	Storm Water inlet for oil separation includes new piping and trenching
Storm Water Pipe	LF	1000	$24.96	$24,960	Storm Water pipe - 12" diameter
CATEGORY SUBTOTAL				**$72,150**	
ELECTRICAL and TELECOMMUNICATIONS					
Electric Distribution Line	LF	500	$15.60	$7,800	Underground electric distribution in condui
Telephone	EA	1	$2,600.00	$2,600	Underground telephone wire in conduit
Transformers	EA	0	$10,400.00	$0	75 KVA
Light poles	ITEM	0	$2,080.00	$0	Cost accounted for in demolition division
CATEGORY SUBTOTAL				**$10,400**	
LANDSCAPE					
Seeding Dryland Grasses	SF	0	$0.10	$0	Allowance. Drilled seeding disturbed areas
Seeding Irrigated Turf Grasses	SF	30000	$0.16	$4,680	Allowance. Drilled seeding disturbed areas
Straw Mulch	SF	0	$0.05	$0	Crimped over seeded areas
Hydro Mulch	SF	30000	$0.05	$1,560	Spray mulch over seeded areas
Deciduous Trees	EA	75	$390.00	$29,250	Allowance. 2.5 " Caliper
Evergreen Trees	EA	25	$364.00	$9,100	Allowance. 8' Average Height
Shrubs	EA	250	$26.00	$6,500	Allowance. 5 Gallon Shrubs
CATEGORY SUBTOTAL				**$51,090**	
IRRIGATION					
Point of Connection	EA	1	$2,080.00	$2,080	Connection to water main, vacuum breaker, controller
Spray Irrigation	SF	80000	$1.04	$83,200	Large Radius Pop Up Heads
Bubbler Irrigation	Per Plant	350	$78.00	$27,300	Bubbler at Trees and Shrubs
CATEGORY SUBTOTAL				**$112,580**	
SUBTOTAL				**$3,742,377**	
CONTRACTORS GENERAL CONDITIONS	**12%**			**$449,085**	
CONCEPT PLAN CONTINGENCY	**25%**			**$935,594**	
GRAND TOTAL				**$5,127,056**	

ITEM	UNIT	UNIT QTY	UNIT COST	EXTENDED COST	NOTES
JAMISON					
DEMOLITION					
Clear and Grub	SF	43560	$0.05	$2,265	Strip site and remove grasses and shrubs
Remove Existing Concrete trails	SF	0	$0.78	$0	See Overall Trails Cost Division at end of document
Remove Existing Asphalt Pavement	SF	41500	$0.78	$32,370	
Remove Existing Traffic Signs	ALLOW	1	$1,040.00	$1,040	Store and reinstall at future locations
Remove and relocate wheel stops	EA	61	$10.40	$634	Remove, store and relocate
Demolish & Remove Existing Restroom	ALLOW	1	$5,200.00	$5,200	
CATEGORY SUBTOTAL				**$41,510**	
EARTHWORK					
Bulk Earthwork	CY	3000	$4.16	$12,480	
Bulk Embankment	CY	3000	$2.08	$6,240	(fill = 3000 CY)
Rock Removal	Allow	1	$5,200.00	$5,200	Allowance for unclassified rock removal
Excavation and Hauling	CY	10000	$3.12	$31,200	Includes excavation and 1 mile haul to construction site
Topsoil - Strip , Stockpile and Spread	CY	1390	$4.16	$5,782	Assumes 6" depth removal at surfaced areas, stockpile, and spread all new landscape areas
Fine Grading	SF	5000	$0.05	$260	Assumes all paved and landscape areas
CATEGORY SUBTOTAL				**$61,162**	
ROADS AND PARKING					
Asphalt	SF	41500	$2.31	$95,738	Includes new asphalt for regraded area
Striping	ALLOW	1	$1,040.00	$1,040	
CATEGORY SUBTOTAL				**$96,778**	
TRAILS					
Concrete Trails	SF	1000	$3.64	$3,640	See Overall Trails Cost Division at end of documen
CATEGORY SUBTOTAL				**$3,640**	
STRUCTURES					
Restroom Building	SF	0	$234.00	$0	new restroom - four fixtures total
CATEGORY SUBTOTAL				**$0**	
FURNISHINGS					
Picnic Tables	EA	0	$104.00	$0	Store and relocate picnic tables under relocated shelters
Benches	ITEM	0	$78.00	$0	Store and relocate at future location
Water fountain	ITEM	0	$0.00	$0	2 attached per restroom building, part of Restroom cost.
Dumpsters	ITEM	0	$780.00	$0	Store and reinstall at future locations
Trash Receptacles	ITEM	0	$52.00	$0	Store and reinstall at future locations
Grills	ITEM	0	$78.00	$0	Store and reinstall at future locations
Regulatory Signs	ALLOW	0	$208.00	$0	Cost accounted for in demolition division
CATEGORY SUBTOTAL				**$0**	
UTILITIES					
Water Line	LF	0	$7.80	$0	1" diameter water distribution line
Sanitary Sewer Lateral Line	LF	0	$12.48	$0	4" diameter sewer lateral
Sanitary Sewer Manhole	EA	0	$3,640.00	$0	
Water Hydrants	EA	0	$1,560.00	$0	Frost Free Hydrant Includes connection to local piping and trenching costs
Lift Station	ITEM	0	$0.00	$0	not affected
Storm Water Inlets	EA	0	$3,640.00	$0	Storm Water inlet includes new piping and trenching
Storm Water Oil Separator Inlets	EA	0	$10,400.00	$0	Storm Water inlet for oil separation includes new piping and trenching
Storm Water Pipe	LF	0	$24.96	$0	Storm Water pipe - 12" diameter
CATEGORY SUBTOTAL				**$0**	
ELECTRICAL and TELECOMMUNICATIONS					
Electric Distribution Line	LF	0	$15.60	$0	Underground electric distribution in conduit
Telephone	EA	0	$2,600.00	$0	Underground telephone wire in conduit
Transformers	EA	0	$2,600.00	$0	75 KVA
Light poles	ITEM	0	$3,120.00	$0	Cost accounted for in demolition divisior
CATEGORY SUBTOTAL				**$0**	

LANDSCAPE					
Seeding Dryland Grasses	SF	0	$0.10	$0	Allowance. Drilled seeding disturbed areas.
Straw Mulch	SF	0	$0.05	$0	Crimped over seeded areas
Hydro Mulch	SF	0	$0.05	$0	Spray mulch over seeded areas
Deciduous Trees	EA	0	$390.00	$0	Allowance. 2.5 " Caliper
Evergreen Trees	EA	0	$364.00	$0	Allowance. 8' Average Height
Shrubs	EA	0	$26.00	$0	Allowance. 5 Gallon Shrubs
CATEGORY SUBTOTAL				**$0**	
IRRIGATION					
Point of Connection	EA	0	$2,080.00	$0	Connection to water main, vacuum breaker, controller
Spray Irrigation	SF	0	$1.04	$0	Large Radius Pop Up Heads
Bubbler Irrigation	Per Plant	0	$78.00	$0	Bubbler at Trees and Shrubs
CATEGORY SUBTOTAL				**$0**	
SUBTOTAL				**$203,090**	
CONTRACTORS GENERAL CONDITIONS	**12%**			**$24,371**	
CONCEPT PLAN CONTINGENCY	**25%**			**$50,772**	
GRAND TOTAL				**$278,233**	

ITEM	UNIT	UNIT QTY	UNIT COST	EXTENDED COST	NOTES
CATFISH FLATS - GROUP AREA 1 & 2					
DEMOLITION					
Clear and Grub	SF	43560	$0.05	$2,265	Strip site and remove grasses and shrubs
Remove Existing Concrete trails	SF	18392	$0.78	$14,346	
Remove Existing Asphalt Pavement	SF	0	$0.78	$0	
Remove and relocate wheel stops	EA	0	$10.40	$0	Remove, store and relocate
Demolish & Remove Existing Restroom	ALLOW	0	$5,200.00	$0	
Remove Existing shelter structures, store, demolish walls	EA	1	$10,400.00	$10,400	
CATEGORY SUBTOTAL				**$27,011**	
EARTHWORK					
Bulk Embankment	CY	5000	$2.08	$10,400	no fill
Rock Removal	Allow	1	$10,400.00	$10,400	Allowance for unclassified rock removal
Excavation and Hauling	CY	10000	$3.12	$31,200	Includes excavation and 1 mile haul to construction site
Topsoil - Strip , Stockpile and Spread	CY	1420	$4.16	$5,907	Assumes 6" depth removal at surfaced areas, stockpile, and spread all new landscape areas
Fine Grading	SF	7000	$0.05	$364	Assumes all paved and landscape areas
CATEGORY SUBTOTAL				**$58,271**	
ROADS AND PARKING					
Asphalt	SF	0	$2.31	$0	
Striping	ALLOW	0	$1,040.00	$0	
Curb and gutter	LF	0	$8.32	$0	
CATEGORY SUBTOTAL				**$0**	
TRAILS					
Concrete Trails	SF	5000	$3.64	$18,200	See Overall Trails Cost Division at end of document
CATEGORY SUBTOTAL				**$18,200**	
STRUCTURES					
Restroom Building	SF	0	$234.00	$0	new restroom - four fixtures total
Group Picnic Area 1					75 person capacity
Walls	FF	0	$36.40	$0	135 LF, 56"h
Reinstall Group Shelters	EA	0	$7,800.00	$0	Dimensions of canopies approx:18'x21' ea.- 4 canopies
Day Use Shelter Concrete Pad	SF	0	$3.64	$0	Assume 1000 S.F. per Shelter
Gravel Pavement	SF	0	$0.78	$0	
Picnic Tables	ITEM	0	$104.00	$0	Store and relocate picnic tables under relocated shelters
Grills	ITEM	0	$104.00	$0	Group grill - remove, store and reinstall at future locations
CATEGORY SUBTOTAL				**$0**	
Group Picnic Area 2					75 person capacity
Walls	FF	0	$36.40	$0	135 LF, 56" height
Group Shelters	EA	0	$7,800.00	$0	Dimensions of canopies approx. 18'x21' - 2 canopies
Gravel Pavement	SF	0	$0.78	$0	
Picnic Tables	ITEM	0	$104.00	$0	Store and relocate picnic tables under relocated shelters
Grills	ITEM	0	$104.00	$0	Group grill - remove, store and reinstall at future locations
CATEGORY SUBTOTAL				**$0**	
FURNISHINGS					
Picnic Tables	EA	0	$104.00	$0	Store and relocate picnic tables under relocated shelters
Benches	ITEM	0	$78.00	$0	Store and relocate at future location
Water fountain	ITEM	0	$0.00	$0	2 attached per restroom building, part of Restroom
Dumpsters	ITEM	0	$780.00	$0	Store and reinstall at future locations
Trash Receptacles	ITEM	0	$52.00	$0	Store and reinstall at future locations
Grills	ITEM	0	$78.00	$0	Store and reinstall at future locations
Regulatory Signs	ALLOW	0	$0.00	$0	Cost accounted for in demolition division
CATEGORY SUBTOTAL				**$0**	
UTILITIES					
Water Line	LF	0	$7.80	$0	1" diameter water distribution line
Sanitary Sewer Lateral Line	LF	0	$12.48	$0	4" diameter sewer lateral

ITEM	UNIT	UNIT QTY	UNIT COST	EXTENDED COST	NOTES
Sanitary Sewer Manhole	EA	0	$3,640.00	$0	
Water Hydrants	EA	0	$1,560.00	$0	Frost Free Hydrant Includes connection to local piping and trenching costs
Lift Station	ITEM	0	$0.00	$0	not affected
Storm Water Inlets	EA	0	$3,640.00	$0	Storm Water inlet includes new piping and trenching
Storm Water Oil Separator Inlets	EA	0	$10,400.00	$0	Storm Water inlet for oil separation includes new piping and trenching
Storm Water Pipe	LF	0	$24.96	$0	Storm Water pipe - 12" diameter
CATEGORY SUBTOTAL				**$0**	
ELECTRICAL and TELECOMMUNICATIONS					
Electric Distribution Line	LF	0	$15.60	$0	Underground electric distribution in condui
Telephone	LF	0	$2,600.00	$0	Underground telephone wire in conduit
Transformers	EA	0	$2,600.00	$0	75 KVA
Light poles	ITEM	0	$3,120.00	$0	Cost accounted for in demolition divisior
CATEGORY SUBTOTAL				**$0**	
LANDSCAPE					
Seeding Dryland Grasses	SF	50000	$0.10	$5,200	Allowance. Drilled seeding disturbed areas
Straw Mulch	SF	50000	$0.05	$2,600	Crimped over seeded areas
Hydro Mulch	SF	0	$0.05	$0	Spray mulch over seeded areas
Deciduous Trees	EA	25	$390.00	$9,750	Allowance. 2.5 " Caliper
Evergreen Trees	EA	12	$364.00	$4,368	Allowance. 8' Average Height
Shrubs	EA	50	$26.00	$1,300	Allowance. 5 Gallon Shrubs
CATEGORY SUBTOTAL				**$23,218**	
IRRIGATION					
Point of Connection	EA	1	$2,080.00	$2,080	Connection to water main, vacuum breaker, controller
Spray Irrigation	SF	0	$1.04	$0	Large Radius Pop Up Heads
Bubbler Irrigation	Per Plant	75	$78.00	$5,850	Bubbler at Trees and Shrubs
CATEGORY SUBTOTAL				**$7,930**	
SUBTOTAL				**$134,630**	
CONTRACTORS GENERAL CONDITIONS	**12%**			**$16,156**	
CONCEPT PLAN CONTINGENCY	**25%**			**$33,658**	
GRAND TOTAL				**$184,443**	

ITEM	UNIT	UNIT QTY	UNIT COST	EXTENDED COST	NOTES
FOX RUN					
DEMOLITION					
Clear and Grub	SF	43560	$0.05	$2,265	Strip site and remove grasses and shrubs
Remove Gravel parking area	SF	31000	$0.16	$4,836	
Remove Existing Concrete trails	SF	2000	$0.78	$1,560	
Remove Existing shelter structures, store, demolish walls	ALLOW	1	$10,400.00	$10,400	
Remove horse show boards and store	EA	4	$208.00	$832	
Remove volleyball court posts and store	EA	2	$208.00	$416	
CATEGORY SUBTOTAL				**$20,309**	
EARTHWORK					
Bulk Embankment	CY	6000	$2.08	$12,480	
Rock Removal	Allow	1	$5,200.00	$5,200	Allowance for unclassified rock removal
Excavation and Hauling	CY	7000	$3.12	$21,840	Includes excavation and 1 mile haul to construction site
Topsoil - Strip , Stockpile and Spread	CY	1500	$4.16	$6,240	Assumes 6" depth removal at surfaced areas, stockpile, and spread all new landscape areas
Fine Grading	SF	5000	$0.05	$260	Assumes all paved and landscape areas
CATEGORY SUBTOTAL				**$46,020**	
ROADS AND PARKING					
Asphalt	SF	0	$2.31	$0	
Striping	ALLOW	0	$1,040.00	$0	
Curb and gutter	LF	0	$8.32	$0	
CATEGORY SUBTOTAL				**$0**	
TRAILS					
Concrete Trails	SF	1000	$3.64	$3,640	
CATEGORY SUBTOTAL				**$3,640**	
STRUCTURES					
Portable Restrooms	EA	0	$780.00	$0	Relocate to future location
Group Picnic Area					75 person capacity
Walls	FF	0	$36.40	$0	135 LF, 56"h
Reinstall Group Shelters	EA	0	$10,400.00	$0	Dimensions of canopies approx:18'x21' ea.- canopies
Gravel Pavement	SF	0	$0.78	$0	
Picnic Tables	ITEM	0	$104.00	$0	Store and relocate picnic tables under relocated shelters
Grills	ITEM	0	$104.00	$0	Group grill - remove, store and reinstall at future locations
CATEGORY SUBTOTAL				**$0**	
FURNISHINGS					
Dumpsters	ITEM	0	$780.00	$0	Store and reinstall at future locations
Trash Receptacles	ITEM	0	$52.00	$0	Store and reinstall at future locations
Regulatory Signs	ALLOW	0	$208.00	$0	Remove and relocate to future location
Fencing	LF	0	$10.40	$0	Remove and relocate to future location
CATEGORY SUBTOTAL				**$0**	
RECREATIONAL FACILITIES					
Beach Volleyball Court	ITEM	0	$5,200.00	$0	Includes new sand, reinstalled posts.
Horse Shoe Pits	ITEM	0	$520.00	$0	
CATEGORY SUBTOTAL				**$0**	
UTILITIES					
Water Line	LF	0	$7.80	$0	1" diameter water distribution line
Sanitary Sewer Lateral Line	LF	0	$12.48	$0	4" diameter sewer lateral
Sanitary Sewer Manhole	EA	0	$3,640.00	$0	
Water Hydrants	EA	0	$1,560.00	$0	Frost Free Hydrant Includes connection to local piping and trenching costs
Lift Station	ITEM	0	$0.00	$0	not affected
Storm Water Inlets	EA	0	$3,640.00	$0	Storm Water inlet includes new piping and trenching
Storm Water Oil Separator Inlets	EA	0	$10,400.00	$0	Storm Water inlet for oil separation includes new piping and trenching
Storm Water Pipe	LF	0	$24.96	$0	Storm Water pipe - 12" diameter
CATEGORY SUBTOTAL				**$0**	
ELECTRICAL and TELECOMMUNICATIONS					
Electric Distribution Line	LF	0	$15.60	$0	Underground electric distribution in condui
Telephone	EA	0	$2,600.00	$0	Underground telephone wire in condui
Transformers	EA	0	$2,600.00	$0	75 KVA
Light poles	ITEM	0	$3,120.00	$0	Cost accounted for in demolition divisior
CATEGORY SUBTOTAL				**$0**	

LANDSCAPE					
Seeding Dryland Grasses	SF	5000	$0.10	$520	Allowance. Drilled seeding disturbed areas.
Straw Mulch	SF	5000	$0.05	$260	Crimped over seeded areas
Hydro Mulch	SF	0	$0.05	$0	Spray mulch over seeded areas
Deciduous Trees	EA	20	$390.00	$7,800	Allowance. 2.5 " Caliper
Evergreen Trees	EA	5	$364.00	$1,820	Allowance. 8' Average Height
Shrubs	EA	20	$26.00	$520	Allowance. 5 Gallon Shrubs
CATEGORY SUBTOTAL				**$10,920**	
IRRIGATION					
Point of Connection	EA	1	$2,080.00	$2,080	Connection to water main, vacuum breaker, controller
Spray Irrigation	SF	0	$1.04	$0	Large Radius Pop Up Heads
Bubbler Irrigation	Per Plant	0	$78.00	$0	Bubbler at Trees and Shrubs
CATEGORY SUBTOTAL				**$2,080**	
SUBTOTAL				**$82,969**	
CONTRACTORS GENERAL CONDITIONS	**12%**			**$9,956**	
CONCEPT PLAN CONTINGENCY	**25%**			**$20,742**	
GRAND TOTAL				**$113,668**	

ITEM	UNIT	UNIT QTY	UNIT COST	EXTENDED COST	NOTES
KINGFISHER AREA					
DEMOLITION					
Clear and Grub	SF	43560	$0.05	$2,265	Strip site and remove grasses and shrubs
Remove Existing Traffic Signs	ALLOW	1	$520.00	$520	Store and reinstall at future locations
Remove & Relocate Post and cable fencing	LF	375	$10.40	$3,900	
Remove and relocate wheel stops	EA	28	$10.40	$291	Remove existing and relocate to future location
CATEGORY SUBTOTAL				**$6,976**	
EARTHWORK					
Bulk Embankment	CY	2500	$2.08	$5,200	
Rock Removal	Allow	1	$2,600.00	$2,600	Allowance for unclassified rock removal
Excavation and Hauling	CY	2500	$3.12	$7,800	Includes excavation and 1 mile haul to construction site
Topsoil - Strip , Stockpile and Spread	CY	850	$4.16	$3,536	Assumes 6" depth removal at surfaced areas, stockpile, and spread all new landscape areas
Fine Grading	SF	46000	$0.05	$2,392	Assumes all paved and landscape areas
CATEGORY SUBTOTAL				**$21,528**	
ROADS AND PARKING					
Gravel	SF	38000	$0.78	$29,640	
CATEGORY SUBTOTAL				**$29,640**	
FURNISHINGS					
Portable Restrooms	EA	1	$780.00	$780	Relocate to future location
Dumpsters	ITEM	1	$780.00	$780	Store and reinstall at future locations
Trash Receptacles	ITEM	1	$52.00	$52	Store and reinstall at future locations
Regulatory Signs	ALLOW	0	$208.00	$0	Cost accounted for in demolition division
CATEGORY SUBTOTAL				**$1,612**	
LANDSCAPE					
Seeding Dryland Grasses	SF	43560	$0.10	$4,530	Allowance. Drilled seeding disturbed areas.
Straw Mulch	SF	43560	$0.05	$2,265	Crimped over seeded areas
Hydro Mulch	SF	0	$0.05	$0	Spray mulch over seeded areas
Deciduous Trees	EA	10	$390.00	$3,900	Allowance. 2.5 " Caliper
Evergreen Trees	EA	10	$364.00	$3,640	Allowance. 8' Average Height
Shrubs	EA	25	$26.00	$650	Allowance. 5 Gallon Shrubs
CATEGORY SUBTOTAL				**$14,985**	
IRRIGATION					
Point of Connection	EA	1	$2,080.00	$2,080	Connection to water main, vacuum breaker, controller
Spray Irrigation	SF	0	$1.04	$0	Large Radius Pop Up Heads
Bubbler Irrigation	Per Plant	45	$78.00	$3,510	Bubbler at Trees and Shrubs
CATEGORY SUBTOTAL				**$5,590**	
SUBTOTAL				**$80,332**	
CONTRACTORS GENERAL CONDITIONS	**12%**			**$9,640**	
CONCEPT PLAN CONTINGENCY	**25%**			**$20,083**	
GRAND TOTAL				**$110,054**	

ITEM	UNIT	UNIT QTY	UNIT COST	EXTENDED COST	NOTES
GRAVEL POND AREA					
DEMOLITION					
Clear and Grub	SF	43560	$0.05	$2,265	Strip site and remove grasses and shrubs
Remove Existing Regulatory Signs	ALLOW	1	$208.00	$208	Remove, store and reinstall at future locations
Remove and relocate wheel stops	EA	38	$10.40	$395	Remove, store and relocate
Remove & Relocate Post and cable fencing	LF	596	$10.40	$6,198	
CATEGORY SUBTOTAL				**$9,067**	
EARTHWORK					
Bulk Embankment	CY	1000	$2.08	$2,080	(fill = 1000 CY cut = 1000 CY)
Rock Removal	Allow	1	$1,040.00	$1,040	Allowance for unclassified rock removal
Excavation and Hauling	CY	1000	$3.12	$3,120	Includes excavation and 1 mile haul to construction site
Topsoil - Strip , Stockpile and Spread	CY	850	$4.16	$3,536	Assumes 6" depth removal at surfaced areas, stockpile, and spread all new landscape areas
Fine Grading	SF	45000	$0.05	$2,340	Assumes all paved and landscape areas
CATEGORY SUBTOTAL				**$12,116**	
ROADS AND PARKING					
Asphalt	SF	10000	$2.31	$23,100	Includes new asphalt for regraded area
Bridge	EA	0	$300,000.00	$0	Include installation costs
CATEGORY SUBTOTAL				**$23,100**	
STRUCTURES					
Portable Restrooms	EA	0	$780.00	$0	Relocate to future location
CATEGORY SUBTOTAL				**$0**	
FURNISHINGS					
Picnic Tables	EA	0	$104.00	$0	Store and relocate picnic tables under relocated shelters
Dumpsters	ITEM	0	$780.00	$0	Store and reinstall at future locations
Trash Receptacles	ITEM	0	$52.00	$0	Store and reinstall at future locations
Grills	ITEM	0	$78.00	$0	Store and reinstall at future locations
Regulatory Signs	ALLOW	0	$208.00	$0	Cost accounted for in demolition divisior
CATEGORY SUBTOTAL				**$0**	
LANDSCAPE					
Seeding Dryland Grasses	SF	0	$0.10	$0	Allowance. Drilled seeding disturbed areas
Straw Mulch	SF	0	$0.05	$0	Crimped over seeded areas
Hydro Mulch	SF	0	$0.05	$0	Spray mulch over seeded areas
Deciduous Trees	EA	0	$390.00	$0	Allowance. 2.5 " Caliper
Evergreen Trees	EA	0	$364.00	$0	Allowance. 8' Average Height
Shrubs	EA	0	$26.00	$0	Allowance. 5 Gallon Shrubs
CATEGORY SUBTOTAL				**$0**	
IRRIGATION					
Point of Connection	EA	1	$2,080.00	$2,080	Connection to water main, vacuum breaker, controller
Spray Irrigation	SF	0	$1.04	$0	Large Radius Pop Up Heads
Bubbler Irrigation	Per Plant	0	$78.00	$0	Bubbler at Trees and Shrubs
CATEGORY SUBTOTAL				**$2,080**	
SUBTOTAL				**$46,363**	
CONTRACTORS GENERAL CONDITIONS	**12%**			**$5,564**	
CONCEPT PLAN CONTINGENCY	**25%**			**$11,591**	
GRAND TOTAL				**$63,517**	
~~PLATTE RIVER~~					
EXISTING AREA IS NOT DISTURBED					

ITEM	UNIT	UNIT QTY	UNIT COST	EXTENDED COST	NOTES
MARINA POINT					
DEMOLITION					
Clear and Grub	SF	43560	$0.05	$2,265	Strip site and remove grasses and shrubs
Remove Existing shelter structures, store	ALLOW	1	$20,800.00	$20,800	6 canopies
Remove Existing Concrete Plaza at group area	SF	5088	$0.78	$3,969	
Remove Existing Concrete trails	SF	38000	$0.78	$29,640	Includes Riverside South Ramp trails
Remove Existing Asphalt Pavement	SF	155000	$0.78	$120,900	
Remove Existing Regulatory Signs	ALLOW	1	$208.00	$208	
Remove and relocate wheel stops	EA	200	$10.40	$2,080	Remove, store and relocate
Remove & relocate timber fencing	LF	138	$10.40	$1,435	
Demolish & Remove Existing Restroom	ALLOW	1	$5,200.00	$5,200	
Remove & Relocate Existing Light Poles	EA	3	$3,120.00	$9,360	
Remove horse show boards and store	EA	4	$208.00	$832	
Remove volleyball court posts and store	EA	2	$208.00	$416	
CATEGORY SUBTOTAL				**$197,105**	
EARTHWORK					
Bulk Embankment	CY	1000	$2.08	$2,080	Earthworks accounted for in Riverside Area takeoffs.
Rock Removal	Allow	1	$1,040.00	$1,040	Allowance for unclassified rock removal
Excavation and Hauling	CY	1000	$3.12	$3,120	site
Topsoil - Strip , Stockpile and Spread	CY	4350	$4.16	$18,096	Assumes 6" depth removal at surfaced areas, stockpile, and spread all new landscape areas
Fine Grading	SF	240000	$0.05	$12,480	Assumes all paved and landscape areas
CATEGORY SUBTOTAL				**$36,816**	
ROADS AND PARKING					
Asphalt	SF	86679	$2.31	$199,963	Includes new asphalt for regraded area
Striping	ALLOW	1	$2,080.00	$2,080	
CATEGORY SUBTOTAL				**$202,043**	
TRAILS					
Concrete Trails	SF	36000	$3.64	$131,040	Assumes 6' wide path, all proposed trails for Marina Point, Riverside, south ramp, to Roxborough Cove
CATEGORY SUBTOTAL				**$131,040**	
STRUCTURES					
Group Picnic - Marina Point					125 person capacity
Walls	FF	630	$36.40	$22,932	135 LF, 56"h
	ALLOW	1	$20,800.00	$20,800	Dimensions of canopies approx:18'x21' ea.- 6 canopies
Reinstall Group Shelters					
Day Use Shelter Concrete Pad	SF	1000	$3.64	$3,640	Assume 1000 S.F. per Shelter
Concrete Pavement	SF	5088	$3.12	$15,875	
Picnic Tables	ITEM	10	$104.00	$1,040	Store and relocate picnic tables under relocated shelters
Electric hookups	ALLOW	1	$520.00	$520	Provision of conduit and outlets, not connection to power
Grills	ITEM	1	$104.00	$104	Group grill - remove, store and reinstall at future locations
CATEGORY SUBTOTAL				**$64,911**	
ADA Fishing Pier	ALLOW	1	$5,200.00	$5,200	Remove and relocate to future location
Portable Restrooms	EA	1	$780.00	$780	Relocate to future location
Restroom Building	SF	1100	$234.00	$257,400	
CATEGORY SUBTOTAL				**$263,380**	

ITEM	UNIT	UNIT QTY	UNIT COST	EXTENDED COST	NOTES
FURNISHINGS					
Picnic Tables	EA	0	$104.00	$0	Qty allowed for in group structure
Benches	ITEM	1	$104.00	$104	Store and reinstall at future locations
Water fountain	ITEM	2	$0.00	$0	2 attached per restroom building - in restroom cost
Dumpsters	ITEM	2	$780.00	$1,560	Store and reinstall at future locations
Trash Receptacles	ITEM	1	$52.00	$52	Store and reinstall at future locations
Regulatory Signs	ALLOW	0	$208.00	$0	Cost accounted for in demolition division
CATEGORY SUBTOTAL				**$1,716**	
RECREATIONAL FACILITIES					
Beach Volleyball Court	ITEM	1	$5,200.00	$5,200	Includes new sand, reinstalled posts.
Horse Shoe Pits	ITEM	2	$520.00	$1,040	
CATEGORY SUBTOTAL				**$6,240**	
UTILITIES					
Water Line	LF	250	$7.80	$1,950	1" diameter water distribution line
Sanitary Sewer Lateral Line	LF	250	$12.48	$3,120	4" diameter sewer lateral
Sanitary Sewer Manhole	EA	2	$3,640.00	$7,280	
Water Hydrants	EA	1	$1,560.00	$1,560	Frost Free Hydrant Includes connection to local piping and trenching costs
Lift Station	ITEM	0	$0.00	$0	not affected
Storm Water Inlets	EA	1	$3,640.00	$3,640	Storm Water inlet includes new piping and trenching
Storm Water Oil Separator Inlets	EA	1	$10,400.00	$10,400	Storm Water inlet for oil separation includes new piping and trenching
Storm Water Pipe	LF	500	$24.96	$12,480	Storm Water pipe - 12" diameter
CATEGORY SUBTOTAL				**$40,430**	
ELECTRICAL and TELECOMMUNICATIONS					
Electric Distribution Line	LF	500	$15.60	$7,800	Underground electric distribution in condui
Telephone	LF	250	$15.60	$3,900	Underground telephone wire in condui
Transformers	EA	2	$2,600.00	$5,200	75 KVA
Light poles	ITEM	0	$3,120.00	$0	Cost accounted for in demolition divisior
CATEGORY SUBTOTAL				**$16,900**	
LANDSCAPE					
Seeding Dryland Grasses	SF	86000	$0.10	$8,944	Allowance. Drilled seeding disturbed areas
Straw Mulch	SF	86000	$0.05	$4,472	Crimped over seeded areas
Hydro Mulch	SF	0	$0.05	$0	Spray mulch over seeded areas
Deciduous Trees	EA	40	$390.00	$15,600	Allowance. 2.5 " Caliper
Evergreen Trees	EA	20	$364.00	$7,280	Allowance. 8' Average Height
Shrubs	EA	100	$26.00	$2,600	Allowance. 5 Gallon Shrubs
CATEGORY SUBTOTAL				**$38,896**	
IRRIGATION					
Point of Connection	EA	1	$2,080.00	$2,080	Connection to water main, vacuum breaker, controller
Spray Irrigation	SF	0	$1.04	$0	Large Radius Pop Up Heads
Bubbler Irrigation	Per Plant	160	$78.00	$12,480	Bubbler at Trees and Shrubs
CATEGORY SUBTOTAL				**$14,560**	
SUBTOTAL				**$1,014,036**	
CONTRACTORS GENERAL CONDITIONS	**12%**			**$121,684**	
CONCEPT PLAN CONTINGENCY	**25%**			**$253,509**	
GRAND TOTAL				**$1,389,230**	

ITEM	UNIT	UNIT QTY	UNIT COST	EXTENDED COST	NOTES
SOUTH RAMP including RIVERSIDE MARINA					
DEMOLITION					
Clear and Grub	SF	43560	$0.05	$2,265	Strip site and remove grasses and shrubs
Remove Existing Concrete trails	SF	0	$0.78	$0	Cost accounted for in Marina Point costs.
Remove Existing Asphalt Pavement	SF	148000	$0.78	$115,440	
Remove Existing Traffic Signs	ALLOW	1	$1,040.00	$1,040	Store and reinstall at future locations
Demolish Existing Buildings	ALLOW	1	$15,600.00	$15,600	
Remove & Relocate Existing Shade Structure	EA	3	$10,400.00	$31,200	
Remove and relocate wheel stops	EA	124	$10.40	$1,290	Remove, store and relocate
Remove and relocate Information Kiosk Signage	EA	1	$1,040.00	$1,040	
Remove & Relocate Existing Light Poles	EA	1	$3,120.00	$3,120	
Remove horse show boards and store	EA	4	$208.00	$832	
Remove volleyball court posts and store	EA	2	$208.00	$416	
CATEGORY SUBTOTAL				**$172,243**	
EARTHWORK					
Marina excavation	allow	1	$884,000.00	$884,000	Allows for excavating reservoir floor to operate at 5717, and extend breakwater, relocation of marina docks and shoring during construction and relocating at present location after construction.
Excavation and Hauling	CY	370000	$2.08	$769,600	Includes excavation and 1 mile haul to construction site
Bulk Earthwork	CY	370000	$2.08	$769,600	(Fill =370,000 CY)
Rock Removal	Allow	1	$26,000.00	$26,000	Allowance for unclassified rock removal
Topsoil - Strip , Stockpile and Spread	CY	3700	$4.16	$15,392	Assumes 6" depth removal at surfaced areas, stockpile, and spread all new landscape areas
Fine Grading	SF	200000	$0.05	$10,400	Assumes all paved and landscape areas
CATEGORY SUBTOTAL				**$2,474,992**	
ROADS AND PARKING					
Asphalt	SF	148000	$2.31	$341,426	Includes new asphalt for regraded area
Striping	ALLOW	1	$2,600.00	$2,600	
CATEGORY SUBTOTAL				**$344,026**	
BOAT RAMPS & MARINA					
Concrete	SF	5000	$8.32	$41,600	Includes all launch lanes (2'
Rip Rap Shoreline	SY	8000	$26.00	$208,000	Construction of a 2:1 Rip Rap slope at shoreline. See Appendix for sketch alternatives for treatments. Rip Rap being the preferred.
Upgrade of marina cables and winches	Allow	1	$520,000.00	$520,000	Upgrade of winches and cables for operation for water levels 5744 to 5717.
CATEGORY SUBTOTAL				**$769,600**	
TRAILS					
Concrete Trails	SF	0	$3.64	$0	Cost accounted for in Marina Point costs.
CATEGORY SUBTOTAL				**$0**	
STRUCTURES					
Group Picnic - Riverside					125 person capacity
Walls	FF	630	$36.40	$22,932	135 LF, 56"h
	ALLOW	1	$10,400.00	$10,400	Dimensions of canopies approx:18'x21' ea.- 6 canopies
Reinstall Group Shelters	SF	1000	$3.64	$3,640	Assume 1000 S.F. per Shelter
Day Use Shelter Concrete Pad	SF	5088	$3.12	$15,875	
Concrete Pavement	ITEM	10	$104.00	$1,040	Store and relocate picnic tables under relocated shelters
Picnic Tables	ALLOW	1	$520.00	$520	Provision of conduit and outlets, not connection to power
Electric hookups	ITEM	1	$104.00	$104	Group grill - remove, store and reinstall at future locations
Grills					
CATEGORY SUBTOTAL				**$54,511**	
Marina Building and Restaurant	SF	4500	$78.00	$351,000	Relocate Marina Building and restaurant to ground
Restroom and Shower Building	SF	1600	$234.00	$374,400	Replace restroom and shower building
Day Use Shelter	EA	3	$0.00	$0	Cost to relocate accounted for in demolition division
Information kiosk	EA	1	$0.00	$0	Cost to relocate accounted for in demolition division
CATEGORY SUBTOTAL				**$725,400**	
FURNISHINGS					

ITEM	UNIT	UNIT QTY	UNIT COST	EXTENDED COST	NOTES
Picnic Tables	EA	3	$104.00	$312	Store and relocate picnic tables under relocated shelters
Benches	ITEM	1	$104.00	$104	Store and relocate at future location
Water fountain	ITEM	1	$0.00	$0	Attached per restroom building - in restroom cost
Dumpsters	ITEM	4	$780.00	$3,120	Store and reinstall at future locations
Trash Receptacles	ITEM	4	$52.00	$208	Store and reinstall at future locations
Bollards	ITEM	4	$156.00	$624	gate posts at launch ramps - store and relocate in existing location
Grills	ITEM	3	$78.00	$234	Store and reinstall at future locations
Regulatory Signs	ALLOW	0	$208.00	$0	Cost accounted for in demolition divisior
CATEGORY SUBTOTAL				**$4,602**	
RECREATIONAL FACILITIES					
Beach Volleyball Court	ITEM	1	$5,200.00	$5,200	Includes new sand, reinstalled posts
Horse Shoe Pits	ITEM	2	$520.00	$1,040	
CATEGORY SUBTOTAL				**$6,240**	
UTILITIES					
Water Line	LF	250	$7.80	$1,950	1" diameter water distribution line
Sanitary Sewer Lateral Line	LF	250	$12.48	$3,120	4" diameter sewer lateral
Sanitary Sewer Manhole	EA	2	$3,640.00	$7,280	
Water Hydrants	EA	1	$1,560.00	$1,560	Frost Free Hydrant Includes connection to local piping and trenching costs
Lift Station	ITEM	0	$0.00	$0	not affected
Storm Water Inlets	EA	2	$3,640.00	$7,280	Storm Water inlet includes new piping and trenching
Storm Water Oil Separator Inlets	EA	2	$10,400.00	$20,800	Storm Water inlet for oil separation includes new piping and trenching
Storm Water Pipe	LF	500	$24.96	$12,480	Storm Water pipe - 12" diameter
CATEGORY SUBTOTAL				**$54,470**	
ELECTRICAL and TELECOMMUNICATIONS					
Electric Distribution Line	LF	250	$15.60	$3,900	Underground electric distribution in condui
Telephone	LF	1	$2,600.00	$2,600	Underground telephone wire in condui
Transformers	EA	0	$2,600.00	$0	75 KVA
Light poles	ITEM	0	$3,120.00	$0	Cost accounted for in demolition divisior
CATEGORY SUBTOTAL				**$6,500**	
LANDSCAPE					
Seeding Dryland Grasses	SF	130000	$0.10	$13,520	Allowance. Drilled seeding disturbed areas
Straw Mulch	SF	13000	$0.05	$676	Crimped over seeded areas
Hydro Mulch	SF	0	$0.05	$0	Spray mulch over seeded areas
Deciduous Trees	EA	50	$390.00	$19,500	Allowance. 2.5 " Caliper
Evergreen Trees	EA	25	$364.00	$9,100	Allowance. 8' Average Height
Shrubs	EA	100	$26.00	$2,600	Allowance. 5 Gallon Shrubs
CATEGORY SUBTOTAL				**$45,396**	
IRRIGATION					
Point of Connection	EA	1	$2,080.00	$2,080	Connection to water main, vacuum breaker, controller
Spray Irrigation	SF	0	$1.04	$0	Large Radius Pop Up Heads
Bubbler Irrigation	Per Plant	275	$78.00	$21,450	Bubbler at Trees and Shrubs
CATEGORY SUBTOTAL				**$23,530**	
SUBTOTAL				**$4,681,510**	
CONTRACTORS GENERAL CONDITIONS	**12%**			**$561,781**	
CONCEPT PLAN CONTINGENCY	**25%**			**$1,170,377**	
GRAND TOTAL				**$6,413,668**	

ITEM	UNIT	UNIT QTY	UNIT COST	EXTENDED COST	NOTES
ROXBOROUGH COVE					
DEMOLITION					
Clear and Grub	SF	43560	$0.05	$2,265	Strip site and remove grasses and shrubs
Remove Existing Vault Restroom	ALLOW	1	$2,600.00	$2,600	
Remove Existing Regulatory Signs	ALLOW	1	$208.00	$208	Remove, store and reinstall at future locations
CATEGORY SUBTOTAL				**$5,073**	
EARTHWORK					
Bulk Embankment	CY	500	$2.08	$1,040	(Fill = 500 CY, Cut = 500 CY)
Rock Removal	Allow	1	$1,040.00	$1,040	Allowance for unclassified rock removal
Excavation and Hauling	CY	500	$3.12	$1,560	Includes excavation and 1 mile haul to construction site
Topsoil - Strip , Stockpile and Spread	CY	185	$4.16	$770	stockpile, and spread all new landscape areas
Fine Grading	SF	10000	$0.05	$520	Assumes all paved and landscape areas
CATEGORY SUBTOTAL				**$4,930**	
PARKING AREA					
Gravel	SF	7950	$0.78	$6,201	not affected
CATEGORY SUBTOTAL				**$6,201**	
ARCHITECTURE					
Vault Restroom Building	SF	250	$130.00	$32,500	not affected
CATEGORY SUBTOTAL				**$32,500**	
FURNISHINGS					
Picnic Tables	EA	5	$104.00	$520	Store and relocate picnic tables under relocated shelters
Trash Receptacles	ITEM	3	$52.00	$156	Store and reinstall at future locations
Grills	ITEM	5	$78.00	$390	Store and reinstall at future locations
Regulatory Signs	ALLOW	0	$208.00	$0	Cost accounted for in demolition division
CATEGORY SUBTOTAL				**$1,066**	
UTILITIES					
Water Line	LF	0	$7.80	$0	1" diameter water distribution line
Sanitary Sewer Lateral Line	LF	0	$12.48	$0	4" diameter sewer lateral
Sanitary Sewer Manhole	EA	0	$3,640.00	$0	
Water Hydrants	EA	0	$1,560.00	$0	Frost Free Hydrant Includes connection to local piping and trenching costs
Lift Station	ITEM	1	$0.00	$0	not affected
Storm Water Inlets	EA	0	$3,640.00	$0	Storm Water inlet includes new piping and trenching
Storm Water Oil Separator Inlets	EA	0	$10,400.00	$0	Storm Water inlet for oil separation includes new piping and trenching
Storm Water Pipe	LF	0	$24.96	$0	Storm Water pipe - 12" diameter
CATEGORY SUBTOTAL				**$0**	
ELECTRICAL and TELECOMMUNICATIONS					
Electric Distribution Line	LF	0	$15.60	$0	Underground electric distribution in condui
Telephone	LF	0	$2,600.00	$0	Underground telephone wire in conduit
Transformers	EA	0	$2,600.00	$0	75 KVA
Light poles	ITEM	0	$3,120.00	$0	Cost accounted for in demolition division
CATEGORY SUBTOTAL				**$0**	
LANDSCAPE					
Seeding Dryland Grasses	SF	43560	$0.10	$4,530	Allowance. Drilled seeding disturbed areas.
Straw Mulch	SF	43560	$0.05	$2,265	Crimped over seeded areas
Hydro Mulch	SF	0	$0.05	$0	Spray mulch over seeded areas
Deciduous Trees	EA	25	$390.00	$9,750	Allowance. 2.5 " Caliper
Evergreen Trees	EA	15	$364.00	$5,460	Allowance. 8' Average Height
Shrubs	EA	50	$26.00	$1,300	Allowance. 5 Gallon Shrubs
CATEGORY SUBTOTAL				**$23,305**	
IRRIGATION					
Point of Connection	EA	1	$2,080.00	$2,080	Connection to water main, vacuum breaker, controller
Spray Irrigation	SF	0	$1.04	$0	Large Radius Pop Up Heads
Bubbler Irrigation	Per Plant	90	$78.00	$7,020	Bubbler at Trees and Shrubs
CATEGORY SUBTOTAL				**$9,100**	
SUBTOTAL				**$82,175**	
CONTRACTORS GENERAL CONDITIONS	**12%**			**$9,861**	
CONCEPT PLAN CONTINGENCY	**25%**			**$20,544**	
GRAND TOTAL				**$112,580**	

ITEM	UNIT	UNIT QTY	UNIT COST	EXTENDED COST	NOTES
PLUM CREEK PICNIC AREA					
DEMOLITION					
Clear and Grub	SF	43560	$0.05	$2,265	Strip site and remove grasses and shrubs
Remove Gravel parking area	SF	31000	$0.16	$4,836	
Remove Existing Concrete trails	SF	18000	$0.78	$14,040	
Demolish & Remove Existing Restroom	ALLOW	1	$5,200.00	$5,200	
Remove Existing Regulatory Signs	ALLOW	1	$208.00	$208	Remove, store and reinstall at future locations
Remove & Relocate Post and cable fencing	LF	697	$10.40	$7,249	
Remove volleyball court posts and store	EA	2	$208.00	$416	
CATEGORY SUBTOTAL				**$34,214**	
EARTHWORK					
Bulk Embankment	CY	1000	$2.08	$2,080	(fill = 1000CY cut = 1000 CY)
Excavation and Hauling	CY	1000	$3.12	$3,120	Includes excavation and 1 mile haul to construction site
Rock Removal	Allow	1	$1,040.00	$1,040	Allowance for unclassified rock removal
Topsoil - Strip , Stockpile and Spread	CY	185	$4.16	$770	Assumes 6" depth removal at surfaced areas, stockpile, and spread all new landscape areas
Fine Grading	SF	10000	$0.05	$520	Assumes all paved and landscape areas
CATEGORY SUBTOTAL				**$7,530**	
ROADS AND PARKING					
Gravel Parking	SF	20500	$0.78	$15,990	
Gravel entry road	SF	14000	$0.78	$10,920	
CATEGORY SUBTOTAL				**$26,910**	
TRAILS					
Concrete Trails	SF	18000	$3.64	$65,520	
CATEGORY SUBTOTAL				**$65,520**	
STRUCTURES					
Restroom Building	SF	485	$234.00	$113,490	
CATEGORY SUBTOTAL				**$113,490**	
FURNISHINGS					
Picnic Tables	EA	11	$104.00	$1,144	Store and relocate picnic tables under relocated shelters
Benches	ITEM	1	$78.00	$78	Store and relocate at future location
Dumpsters	ITEM	1	$780.00	$780	Store and reinstall at future locations
Grills	ITEM	5	$78.00	$390	Store and reinstall at future locations
Regulatory Signs	ALLOW	0	$208.00	$0	Cost accounted for in demolition division
CATEGORY SUBTOTAL				**$2,392**	
RECREATIONAL FACILITIES					
Beach Volleyball Court	ITEM	1	$5,200.00	$5,200	Includes new sand, reinstalled posts
CATEGORY SUBTOTAL				**$5,200**	
LANDSCAPE					
Seeding Dryland Grasses	SF	43560	$0.10	$4,530	Allowance. Drilled seeding disturbed areas.
Straw Mulch	SF	43560	$0.05	$2,265	Crimped over seeded areas
Hydro Mulch	SF	0	$0.05	$0	Spray mulch over seeded areas
Deciduous Trees	EA	25	$390.00	$9,750	Allowance. 2.5 " Caliper
Evergreen Trees	EA	15	$364.00	$5,460	Allowance. 8' Average Height
Shrubs	EA	50	$26.00	$1,300	Allowance. 5 Gallon Shrubs
CATEGORY SUBTOTAL				**$23,305**	
IRRIGATION					
Point of Connection	EA	1	$2,080.00	$2,080	Connection to water main, vacuum breaker, controller
Spray Irrigation	SF	0	$1.04	$0	Large Radius Pop Up Heads
Bubbler Irrigation	Per Plant	90	$78.00	$7,020	Bubbler at Trees and Shrubs
CATEGORY SUBTOTAL				**$9,100**	
SUBTOTAL				**$287,661**	
CONTRACTORS GENERAL CONDITIONS	**12%**			**$34,519**	
CONCEPT PLAN CONTINGENCY	**25%**			**$71,915**	
GRAND TOTAL				**$394,095**	

ITEM	UNIT	UNIT QTY	UNIT COST	EXTENDED COST	NOTES
~~OVERALL TRAILS - SWIM BEACH TO PLATTE RIVER DAY USE~~					
EXISTING AREA IS NOT DISTURBED					
ROADS					
ROADS AND BRIDGES					
New roads and bridges	LF	4500	$2.31	$10,395	
Earth Fill for roads	LF	1000	$2.08	$2,080	
Road Culvert	LF	1	$160,000.00	$160,000	
CATEGORY SUBTOTAL				**$172,475**	
SUBTOTAL				**$172,475**	
CONTRACTORS GENERAL CONDITIONS	**12%**			**$20,697**	
CONCEPT PLAN CONTINGENCY	**25%**			**$43,119**	
GRAND TOTAL				**$236,291**	
PROJECT TOTAL SUMMARY (All Project Areas as Detailed Above)					
SUBTOTAL				**$11,226,652**	
CONTRACTORS GENERAL CONDITIONS	**12%**			**$1,347,198**	
CONCEPT PLAN CONTINGENCY	**25%**			**$2,806,663**	
GRAND TOTAL				**$15,380,513**	

CHATFIELD RESERVOIR RECREATION MITIGATION STUDY EDAW, Inc.
CONCEPT PLAN COST ESTIMATE 6 September 2006

PLAN AREA	TOTAL COST
North Ramp	$414,847
Massey Draw	$185,306
Eagle Cove	$98,882
Park Entrance Station - Deer Creek	N/A
Deer Creek - Day Use	N/A
Deer Creek - Balloon Staging Area	N/A
Swim Beach	$3,742,377
Jamison	$203,090
Catfish Area 1 &2	$134,630
Fox Run	$82,969
Kingfisher Area	$80,332
Gravel Ponds Area	$46,363
Platte River	N/A
Marina Point	$1,014,036
South Ramp Including Marina	$4,681,510
Roxborough Cove	$82,175
Plum Creek	$287,661
Overall Trails	N/A
Roads and Bridges	$172,475
Reallocation Subtotal	**$11,226,652**

Cost Estimate Allowances		
Contractors General Conditions	12%	$1,347,198
Concept Design Contingency	25%	$2,806,663
Grand Total Allowances		$4,153,861

Reallocation Total	**$15,380,513**

Design Services Allowance		
Design Allowance (Pre-Design, Special Services, Final	17%	$2,614,687
Construction Phase Services	8%	$1,230,441
Owners Construction Phase Contingency	6%	$922,831
Grand Total Design Services Allowances		$4,767,959

Reallocation Grand Total	**$20,148,472**

Appendix 6. USACE Land Use Guidance and Exception

STATE OF COLORADO

Colorado Water Conservation Board
Department of Natural Resources
1313 Sherman Street, Room 721
Denver, Colorado 80203
Phone: (303) 866-3441
Fax: (303) 866-4474
www.cwcb.state.co.us

November 26, 2008

Mr. Eric Laux, Project Manager
Attn: CENWO-PM-AP
U.S. Army Corps of Engineers, Omaha District
1616 Capitol Ave.
Omaha, NE 68102-4901

Re: Chatfield Reallocation Study – Land Use Development Policy (LUDP) Guidance

Dear Mr. Laux:

This letter is in response to our November 25, 2008 conference call regarding the above referenced subject. The State of Colorado and other stakeholders participating in this effort seek your guidance and conditional approval for proposed exceptions to the Corps of Engineers (Corps) LUDP as it relates to recreational structures at Chatfield State Park. We fully understand that any such exceptions that may be granted by Corps will not be construed as precedent setting. Given the unique and challenging conditions associated with Chatfield Reservoir in preserving "in kind" facilities and recreational experiences, the non-federal sponsor is proposing placement of closed floodable wet flood-proofed structures within Zone 1 (between elevations 5,444 ft and 5,453.7 ft, MSL) that are capable of withstanding periodic flooding and that can easily be placed back into service following inundation. The elevations referenced herein are based on the assumption of a 20,600 acre-foot reallocation of existing storage space in the reservoir.

Three attachments are provided for your consideration in determining if the proposed structures meet FEMA regulations and simultaneously will be satisfactory to the Corps. Attachment A contains as-built drawings of existing recreation facilities around the reservoir that are in excellent shape today after 30 years of service, a period which included three significant flood events. Details regarding the 1980, 1983, and 1995 flood events are included in Attachment B, along with post-flood photographs of the swim beach facilities. Attachment C is a copy of the existing "Flood Operation Plan" from Colorado State Parks that is used as an SOP in preparing facilities for flooding and the actions taken to bring them back into service after water levels return to normal pool elevations. This "Flood Operation Plan" will be updated with new relevant elevations following approval of these proposed exceptions, and approval of the FR/EIS report. The Flood Plan will be updated to address new elevations and other necessary revisions.

The as-built drawings illustrate the durability and inherent flood damage resistance afforded by the structures. It is understood that any exception granted at this time would be conditional based upon approval of a final recreation modification plan and updated drawings & specifications that meet current building code requirements. Our intent is that the updated plans would incorporate the same structural elements as illustrated by the attached drawings and would meet FEMA requirements for all of the impacted structures. We propose that placement of structures in Zone 1 would include a self-imposed "freeboard" of approximately three feet above elevation 5444. In addition, all electrical facilities associated with the structures, and with any other infrastructure and facilities, would be properly flood-proofed for public safety and operational purposes.

Your consideration of these items and support in assisting in such a short time frame is greatly appreciated. Please let me know if you have any questions or need additional information.

Sincerely,

Thomas W. Browning, Chief
Watershed Protection & Flood Mitigation Section

cc: Randy Behm, Chief
Flood Risk and Floodplain Management Section

Attachment A
As-Built drawings for existing recreation structures at Chatfield State Park

Files are located on the CWCB ftp site: ftp://165.127.23.92/TempStore/

Login: dnrgisdata

Password: TDavis_30

(Hard copies of the drawings will be sent via FedEx)

Attachment B
Previous Flood Events and Recreation Structure Photos

Chatfield High Pools of Record:

1. May 26, 1980: Pool Elevation 5,447.58'
2. June 30, 1983: Pool Elevation 5,447.12'
3. July 4, 1995: Pool Elevation 5,446.40'

Photo Top: Sign at top of structure indicates the level of high water at Chatfield Reservoir during the 1983 spring runoff.

Photo Bottom: Chatfield State Park recreation structures at the swim beach in full operation during the 2007 summer recreation season. Buildings are cleaned and inspected following each flood event, and then re-opened for use following protocol in the "Flood Operation Plan" (see Attachment D).

Attachment C
Chatfield "Flood Operation Plan"

TO: All Chatfield Personnel

REF: Operations Procedure No. 31

SUBJECT: Flood Operation Plan

DATE: March 2007

PURPOSE:

The following is the flood plan for Chatfield State Park. The goal for this procedure is to provide for the protection of facilities and equipment owned or leased by the State of Colorado, Division of Parks. This procedure assumes that flooding would probably be a gradual cumulative situation where there is sufficient time for effective action and not the result of a sudden up stream dam failure.

HISTORY:

In the past, floods have been the result of periods when both runoff and precipitation were high and gate closures were required for downstream sewer line and bridge repairs in the river bed. The lake inflows at the time were in the range of 2,500 to 3,200 cubic feet per second (CFS) while the outflows dropped to 500 CFS. The peak rate of elevation change was between.5 to 1 vertically foot per day. The highest peak was 5,447.08 feet elevation with 53,325 acre feet of storage.

RESPONSIBILITIES:

It is the responsibility of the Park management team and the Park Resource Tech. II to ensure that every safe and practical effort is made to protect or prevent damage to the facilities and equipment of Chatfield State Park. In his absence an alternate will be designated for this duty. Most of the tasks will be performed by Park Maintenance staff with assistance from other FTE and Seasonal personnel. All Primary electric power work, whether "hot" or not, should be performed by professional licensed personnel. It is the responsibility of all personnel to be particularly careful and to observe all safety rules while working under such adverse conditions. Take photos of flooding to document damage for Risk Management and historical record.

GENERAL INFORMATION:

Sand bagging has been attempted during previous floods and found to be totally ineffective. The necessary pumping of leakage from within the sand bag dike area cannot be maintained over the long term and is not cost effective. The affected buildings will suffer some damage to paint, doors, locks, partitions, and some surface materials. Structural damage has been and probably would be minimal.

Electric power systems are high priority simply because they are very expensive to repair in both labor and material and require some lead time for replacement components. Removal of all endangered items is the only cost effective protective measure.

The sewage lift stations, though submersible under normal conditions can be damaged by flood water entering and wicking into the motors through ends of the power cable. It is necessary to remove pumps and control panels. In low lying areas it is necessary to seal all manholes with

ramneck asphalt ribbon to keep manhole lids in place. Lids can be removed by hydraulic pressure and wave action.

Shelters, tables and grills should withstand flooding. The lowest of the sites have been under water without any significant damage. Flotsam may displace a few upright grills. Circuit Breakers at the Marina Point and Riverside Group Picnic Areas need to be removed. and the stainless steel tables should be removed.

1. The **Trigger point** for this plan is a lake elevation of 5,434.00 feet. At this level water is just touching the concrete apron at the swim beach and at the top of the concrete ramp at the South boat ramp.

2. Consider snow pack, runoff, raise rate, weather forecast and ground saturation to make the implementation decision.

3. The management team, using the facility elevation list as a guide and regular inspections will be able to develop action plans to manage the situation.

4. The Corps of Engineer's automatic lake elevation gauge is accessible by telephone. The current lake elevation determined by counting tone codes which represent the TENS, UNITS and two DECIMAL digits of the lake elevation above sea level. Fifty Four hundred feet is the assumed constant to which the last two whole digits and decimal digits are added. The number of short tones (dots) indicate the numbers separated by silent periods. Long tones (dashes) indicate zeros (example; ... _____ .... would indicate 5430.75 feet. The long tone being a zero).

5. Electric power on the Deer Creek meter is the first major concern to be addressed because it is one of the first areas to be affected and the hazards of working on electrical systems with high water.

6. All water faucets, hydrants, and valves should be kept closed or in their normal operating position to prevent contamination from entering the supply system.

ACTION TASKS:

The following Action Tasks should be accomplished in an organized manner without rushing so much as to damage things.

TASK # 1. Remove the contents of all threatened buildings down to the bare walls and floors. Include stored materials, furniture, appliances, bulletin boards poster and etc. Take care to protect these items during removal, transport and storage.

TASK # 2. Remove all dumpsters, trash cans, removable dumpster and toilet screen panels and etc. from the threatened areas. If time and personnel permit, remove and store railroad tie curbing or landscaping timbers and wood fencing which are likely to float away.

TASK # 3. Make the West side electric power system safe by shutting OFF the primary electric power to permit other protection work to proceed on the electric system.
The transformers for Catfish Flats, Jamison, Swimbeach, and lift station #3 may be isolated from the primary feed. The West Entrance station can be re-connected through the Deer Creek Picnic Area transformer and power maintained until elevation 5,446.00.

a. Qualified personnel (Sturgeon Electric Company or others) must open (de-energize) the main primary disconnect switch at Highway 121 and the Corps of Engineers entrance road.

b. Qualified personnel must isolate the primary feed from the transformer at lift station #3 and re-connect to the Deer Creek Picnic Area transformer load with jumper blocks. Termination covers must be placed on the exposed transformer lugs to keep dirt out.

c. Qualified personnel may re-energize the primary feed at the main disconnect switch (in (a.) above) to keep power to the West Entrance as long as possible while removal of other electrical components proceed.

TASK # 4. Remove all electrical components including circuit breaker panel boards with circuit breakers, water heaters, unit heaters and lift station control panels. and pumps. It is recommended that all wires be tagged with permanently marked tape or tags to make re-installation easier.

This can take from one to two hours or more for each unit.

See: Instruction sheet and Decision Point list.

DECISION POINTS:

This list of "ACTION TASKS" will aid planning a course of action that will suit the situation. Due to changes over the years, all areas of the lake shoreline, inlets and low lying picnic areas must be monitored. The elevations are the levels at which water is on the floor of the listed buildings or on the lowest point of the facility. The numbers were developed from actual elevations measured during the previous floods and as-built drawings where necessary. The decision points may not always reflect the access to the facility. If action is taken at each Decision Point, there should be sufficient time to complete the indicated tasks.

ELEVATION		EXPECTED CONDITIONS OR ACTION REQUIRED
5,434.00	-	This is the trigger point for plan implementation
	-	Water at the edge of the concrete apron , the beach where it meets the sand.
	-	Water is at top of concrete on the South boat ramp
ACTION	-	Notify Beach Concessionaire
ACTION	-	Plum Creek Picnic Area
ACTION	-	Seal manhole lids on Plum Creek force main and in Marina area
ACTION		**TASK # 2**
ACTION	-	Swim Beach Complex
ACTION		**TASK #1, TASK #4**
ACTION	-	Lift Station #3 (Swimbeach) and Transformer vault including DRY TYPE transformer
ACTION		**TASK #3, TASK # 4**
5,434.75	-	Water is at the lowest point of the Plum Creek Picnic area road
5,435.33	-	Water is at Swim Beach Complex aid station & bath house floor.
ACTION	-	Transformer at Beach Complex

ACTION **TASK #4**

ACTION - Lift Station #2 (Jamison)
ACTION **TASK #4**

5,436.00 - Water is at Lift Station #3 (Swimbeach) (rim)
5,437.00 - Water is at beach concession floor and facility transformer
5,437.50 - Water is at Lift Station #2 (Jamison)
5,438.25 - Water is at C.S. #14 Plum Creek Picnic Area toilet floor and top of ramps north ramps
5,438.50 - Water at transformer at Lift Station #3 (Swimbeach)
ACTION Beach Complex to Fox Run

ACTION **TASK #2**

ACTION - C.S. #21 Jamison Toilet
ACTION **TASK #1, TASK #4**

ACTION - Lift Station #2 (Jamison) and Transformer

5,440.00 - Water at C.S. #21 Jamison toilet floor, west shore shelters Catfish Flats to Fox Run
ACTION - C.S. #19 (Catfish Flats)
ACTION **TASK #1, TASK #4**

5,441.00 - Water at shelters at east end of North Ramps peninsula
5,441.50 - Water at C.S. #19 Catfish Flats
5,443.00 - Water at Riverside Picnic Area shelter at Marina lot
ACTION - Lift Station #1 (Catfish Flats), Lift Station #5 (North Ramps), and C.S. #28, Riverside GPA
ACTION **TASK #1, TASK #4**

5,444.00 - Water is at Marina Point GPA
5,444.50 - Water is at Lift Station #1 (Catfish Flats)
5,444.75 - Water is at C.S. #28 (Riverside Picnic Area)
5,445.00 - Water is at Riverside Picnic Area east sites
5,445.00 - Water is at Marina Restroom floor
5,445.00 - Water at Platte River Bridge
ACTION - C.S. #22 (Deer Creek Picnic Area)
ACTION **TASK #1 TASK #4**

5,446.00 - Water is at C.S. #22 and transformer at Deer Creek Picnic Area
5,447.08 - Highest water mark on June 30, 1983
5,448.00 - Water at Riverside GPA
ACTION - C.S. #25 (North Ramps, and transformer and Lift Station #5 (North Ramps)
ACTION **TASK #1 TASK #4**

5,449.00 - Water at C.S. #25 at North Ramp
5,449.00 - Water at road in front of C.S. #25 (North Ramps)
5,454.50 - Rim of Lift Station #6 (Roxborough Cove)

* C.S. = Comfort Station

ELECTRICAL EQUIPMENT

INSTRUCTION SHEET

Building and Utility Electrical System Component Removal.

Each of these procedures take about one to two hours per unit to complete and double that to reinstall.

First: Turn off all power to the building.

A. Circuit Breaker Panel Board removal from restroom buildings, aid station, bath house and concession.
   a. Remove panel cover by loosening (not removing) the retaining screws and releasing the latch mechanism.
   b. Disconnect all wires from circuit breakers and tag them for reconnecting later.
   c. Disconnect the three short jumper wires and the main conductors from the 70 or 90 Amp Main breaker.
   d. Remove the four to six bolts or nuts and washers which secure the panel board to the cabinet.
   e. Dismount the entire panel board assembly by pulling forward and out of the cabinet.
   f. Coat all bare copper conductor ends with anti corrosion grease.

B. The Main and Water Heater power panels in the bath house.
   a. Disconnect all wires from the circuit breakers.
   b. Dismount the entire panel board as in A. above.

C. Water Heaters
   a. Disconnect the wiring at the fused switch box for each water heater in the bath house and remove conduit and wire from box, leaving wire and conduit attached to the heaters.
   b. Disconnect the wires and flex conduit at the junction box on the wall adjacent to the heater.
   c. Close inlet and outlet water gate valves and drain the tank. Loosen and disconnect the supply and outlet unions at the top of the tank.
   d. Handle the tank with care during removal to avoid damaging the glass lining.

D. Furnaces or Unit Heaters, Riverside #28 and North Ramps #25.
   a. Disconnect the wiring and flex conduit from the furnace.
   b. Disconnect the thermostat wires from the furnace.
   c. Unscrew the top plenum from the furnace hot air outlet, and raise the plenum about 1/2 to 3/4 inch and temporarily secure while the furnace is slid out and removed. A temporary support may need to be provided.

E. Transformer Primary fuses. (not in vaults)
   NOTE: This procedure must be performed by qualified personnel only.
   a. Disconnect the Primary (15 kv) power at the Service Entrance Oil Switch, or the PSCo cutouts.
   b. Open the transformer cabinet (both doors)
   c. Using a HOT STICK, and 20 kv gloves pull the primary fuses and remove for storage.
   d. Secure the transformer.

F. Transformer Secondary Circuit Breaker Panels.

a. Remove the four to six nuts and washers which secure the side shield panels in the right (secondary) side of the transformer cabinet and remove the panels.
b. Disconnect all of the wires from the circuit breakers and the panel board busses and tag the free ends for re-connection later.
c. Remove the panel board from the cabinet and secure the transformer.

G. Ventilation Blowers.
a. It is not generally cost effective to remove in line blowers located in the back of the small plumber's chases. This is a low priority. The water rarely will get that high.

H. Transformers in Concrete Block Vaults.
NOTE: BE ABSOLUTELY CERTAIN THAT PRIMARY POWER IS DISCONNECTED FROM THE TRANSFORMER.
a. Open the access door to the circuit breaker panel (the cabinet usually located on the inside wall of the vault).
b. Disconnect all wires from the circuit breakers and the panel board busses and tag the free ends for re-connection later.
c. Remove the panel board from the cabinet and secure the cabinet and transformer.
d. Disconnect and remove the DRY type transformer located in the Southwest inside corner of the transformer vault at Lift Station #3 (Swimbeach).

I. Lift Station #1 and #2 (Catfish Flats and Jamison).
a. Open Control Cabinet and disconnect and tag all interconnecting wires for identification.
b. Remove the six nuts and washers from the inside panel mounting studs.
c. Dismount and remove the panel and secure the cabinet.

J. Lift Station #3, the control panel must be removed in the same manner as the other lift stations.

K. Lift Station #4, the control panel must be removed from its cabinet located in the underground vault in the same manner as other Lift Stations.

L. Enhanced reservable Group Picnic Shelters (Riverside & Marina Point)
a. Remove cover plate and remove circuit breakers
b. Remove duplex outlets from wall mounted boxes.

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, OMAHA DISTRICT
1616 CAPITOL STREET
OMAHA NE 68102-9000

January 29, 2009

Hydrologic Engineering Branch

Mr. Thomas Browning, Chief
Watershed Protection & Flood Mitigation Section
Colorado Water Conservation Board
1313 Sherman Street, Room 721
Denver, Colorado 80203

Dear Mr. Browning:

This letter is in response to your request of January 8, 2009, for the Omaha District to consider a waiver to Northwestern Division Regulation 1110-2-5; Land Development Guidance at Corps Reservoir Projects (NWDR 1110-2-5), for the location of recreational structures at Chatfield Reservoir. Your request included background information for the waiver being sought, a completed "Evaluation Criteria for Land Development Proposals", a structural analysis conducted by CH2M Hill, and a "Chatfield Reservoir Recreations Facilities Plan".

As had been previously discussed between Mr. Eric Laux and Mr. Randall Behm of the Omaha District and yourself, the Chatfield Reservoir 20,600 acre foot reallocation currently being studied would change the current pool designations within the reservoir. Currently, Zone 1 is identified as a pool elevation of 5,444.5 feet mean sea level (ft msl) and lower. Under the proposed reallocation plan Zone 1 will be identified as pool elevation 5,453.7 ft msl and lower. Due to the proposed reallocation of the reservoir, the operation of Zone 1 will be increased by 9.2 feet. Under this modification numerous existing recreational structures will be continuously inundated and become unusable. In accordance with NWDR 1110-2-5, structures are not allowed within Zone 1. This requirement is to eliminate structural damages to the recreation structures as well as the Corps of Engineers facilities attributable to flooding, debris and wind-wave forces. A review of existing structures within Chatfield Reservoir indicated that none of the structures could sustain the effects of complete inundation.

Several discussions with Omaha District personnel focused on elevating recreation structures above elevation 5,453.7 ft msl. In those discussions, it became apparent that to make facilities such as the Bath House Complex at the swim beach user friendly, extremely large amounts of fill material and grading would be required. In lieu of making significant changes to the existing terrain to accommodate the recreation facilities you were requested to provide a structural assessment for the conceptual design of structures which could undergo periods of inundation without resulting in significant damage to the structure. A review of the results of the structural assessment indicates that by modifying the general building specifications new recreation structures could be designed and placed within an elevation range of 5,447.0 ft msl to 5,453.7 ft msl to undergo periodic inundation without sustaining significant damage.

As previously discussed and noted in your request, acceptance of the structural assessment by the Omaha District does not set a precedent for locating additional structures within Zone 1 of this reservoir beyond those currently being addressed without further review. In addition, acceptance of the structural assessment does not indicate the approval of the placement of similar type structures within Zone 1 of other reservoirs within the regulatory jurisdiction of the Omaha District.

In response to your request for a waiver regarding the placement of recreational structures within the upper range of the reallocated Zone 1 of Chatfield Reservoir, elevation 5,447.0 ft msl to 5,453.7 ft msl, the waiver is granted with the following conditions:

- All structural requirements of the Technical Memorandum, Chatfield Structural Analysis, dated December 2008 are implemented.

- In accordance with NWDR 1110-2-5, an evacuation plan is developed for all recreational activities associated with the proposed structures.

- The proposed structures meet the definition of being closed floodable, wet flood-proofed as specified in NWDR 1110-2-5

- This waiver is applicable to only structures identified as requiring relocation as part of the Chatfield Reallocation Study. Any additional structures will require a separate review.

- Upon completion of construction, the CWCB shall submit a letter, signed by a Professional Engineer, to the Omaha District, Chief, Engineering Division, certifying that all structures associated with this waiver were constructed to the specifications contained within Technical Memorandum, Chatfield Structural Analysis, dated December 2008.

If you have additional concerns or comments regarding this response or our enforcement of NWDR 1110-2-5, please contact Mr. Randall Behm of my staff at (402) 995-2322 or myself anytime at (402) 995- 2093.

Sincerely,

SIGNED

John J. Bertino Jr., P. E.
Chief, Engineering Division

Copies Furnished:

CENWO-OD-TL (F. Rios)
CENWO-PM-AE (Laux)

BEHM/orw/2322

LAUX/CENWO-PM-AE

BRANDON/CENWO-PM-AP

ECKERT-UPTMOR/CENWO-PM-AE

REMUS/CENWO-ED-M

SCHENK/CENWO-OD

BERTINO/CENWO-ED

Appendix 7. Construction Concept Analysis

TECHNICAL MEMORANDUM CH2MHILL

Chatfield Construction Concept Analysis

PREPARED FOR:	Chatfield Reservoir Recreation Relocation Working Group
PREPARED BY:	CH2M HILL
COPIES:	Colorado Water Conservation Board, Department of Natural Resources
DATE:	March 4, 2009

Purpose and Objectives

The purpose of this memorandum is to document the construction concept analysis of replacing recreation facilities at Chatfield State Park. This analysis was performed to provide information for the socio-economic impacts, which are required to be analyzed as part of the EIS. BBC and the Corps of Engineers (Corps) need to know when construction would occur and the duration for construction activities, which influence the nature and amount of lost visitation. The objective of this analysis was to determine the best construction concept that minimizes impacts to: Public, Operations by State Parks and Corps of Engineers, as well as time and cost for the project.

Information Used for Construction Concept

Specified tasks that are assigned in the Corps' Project Management Plan and State Resolution for the Chatfield project:

- Reallocate storage in Chatfield Reservoir from flood storage to multipurpose use
- Appropriate measures be established to at least replace recreational and environmental resources impacted by a revised Chatfield Reservoir operation

Implied tasks to be performed to accomplish the specified tasks:

- Develop and implement a recreation facility plan with the objective to replace with "in-kind" recreation experience for the public.
- Obtain necessary authorizations to implement recreation facility plan.

Constraints determined from current policy and or procedures involving the park.

- Maintain park & concession revenues same as the calendar year immediately prior to construction start.
- Per standard USACE policy, no structures such as restrooms or other closed buildings can be located within the 10-year flood pool (Zone 1). Exception has been approved allowing structure within Zone 1, provided they meet specified conditions.

Critical facts and assumptions that were utilized in this analysis:

Facts

- Chatfield Reservoir generates a substantial amount of revenue to Colorado State Parks, its concessions, and to the surrounding area.
- More than 1.6 million visits occur at the park each year; lake use data for calendar year 2007 shows that majority of visitation and revenue generation occurred between the months of April through September.
- Swimming is the most popular activity, followed by boating; hiking, fishing and camping are also very popular activities.

Assumptions

- Reallocating flood storage to other uses is feasible.
- Corps will allow structures to be placed in Zone 1; minimizing fill requirements.
- Affected Recreational Use Areas and Facilities requiring relocation or redevelopment are:
  - North Boat Ramp
  - Massey Draw
  - Swim Beach Area/Balloon Launch
  - Catfish Flats/Fox Run Group Use Areas
  - Kingfisher/Gravel Pond/Platte River Trailhead Areas
  - Marina Area
  - Plum Creek Area
- The conceptual plans and the cost estimate depict "in-kind" replacement of the facilities.
- Construction timing is important due to potential impacts to public, revenue and cost of construction.
- Construction options will be evaluated based on suitability, feasibility and acceptability.
- Embankment material will be excavated from the project site.
- No unforeseen delays to construction schedule.
- In comparing options, did not consider environmental and cultural resource impacts.

Construction Concept Options Considered

1. Full Park closure for more than 2 years: Park is closed for entire construction period of 2 years or more.
2. Full Park closure for less than 2 years: Park is closed for entire construction period for up to 2 years.
3. Construction with no park closure: Construction would occur while park remained open but individual facilities would be closed during their respective construction period.

4. Construction in one off-season: Construction would be done, start to finish, in one 7 month off-season.
5. Construction in multiple off-seasons: Construction would occur in recreation off-season over multiple off-season periods.
6. Construction in combination of off-season and high-use season: Facilities with no alternate location, such as swim beach, marina facilities and dive pond, would have their respective construction period during the off-season. Facilities with alternate locations (boat ramp, picnic areas) would occur during high-use recreation season, respectively closed during construction.

Discriminating Criteria

Each option must meet the following criteria to be considered. If any one of the three criteria is not met, the option falls out and is not considered viable for further consideration.

- **Suitability**: During construction activities, does the option minimize impact to the public and park's revenue, as well as provide reasonable control on construction costs?
- **Feasibility**: Does the option have the capability to accomplish the mission in terms of space, time and resources available?
- **Acceptability**: Does the advantage gained by this option justified by the tradeoffs incurred? I.e. political reality outweighs increase in cost; increased cost and time of option is not outweighed by public benefit.

TABLE 1
Evaluation of Potential Options

Option	Suitability	Feasibility	Acceptability
1. Full Park Closure > 2 yrs	No	Yes	No
2. Full Park Closure < 2 yrs	Yes	Yes	Yes
3. Construction with no park closure	Yes	No	Yes
4. Construction in one off-season	Yes	No	Yes
5. Construction in multiple off-seasons	Yes	Yes	Yes
6. Construction in combination of off-season and high-season	Yes	Yes	Yes

Option Analysis

Options that meet all three discriminatory criteria and move forward for further analysis:

Option 2 – Full Park closure for less than 2 years: Park is closed for entire construction period for up to 2 years.

Option 5 – Construction in multiple off-seasons: Construction would occur in recreation off-season over multiple off-season periods.

Option 6 – Construction in combination of off-season and high-use season: Facilities with no alternate location, such as Swim beach, marina facilities and dive pond, would have their respective construction period during the off-season. Facilities with alternate locations (boat ramp, picnic areas) would occur during high-use recreation season, respectively closed during construction.

Attachment A is a CD containing construction schedule files for options two, five and six. The files come in both Acrobat and MS Projects file format. The latter format can be used for future detailed construction scheduling analysis.

Evaluation Criteria

Evaluation criteria are those factors used to measure the relative effectiveness and efficiency of one option related to the other.

- Cost: increased costs due to multiple start and stop, as well as degree of revenue reimbursement required for the park and concessionaires.
- Time: overall duration of construction.
- Impacts: number of recreation facilities with no alternate location that potentially remain closed, because of construction activities, during recreation season.

Option Evaluation

Option 2: Full park closure < 2 years

- Construction duration 15 to 20 months, beginning in SEP of year 1 and completed by APR year 2.
- Multiple crews working 8-10 hr days simultaneously on 4 to 5 activities/locations.
- One high-use season is impacted.

TABLE 2
Option 2 Evaluation

Criteria	Result
Cost	Substantial revenue reimbursement required No construction stop/start
Time	1 year, 8 months beginning in September year 1
Impacts	All facilities in high-use season complete closure

Strengths:

Shortest construction period

Only 1 season impacted

Quickest option for water storage

Efficient construction/cost savings

Public Safety

Weaknesses:

Impact to public/politics

Payment for lost revenue

Option 5: Multiple Off-Season (Sep 16 – May 14)

- Construction duration nearly 5 years beginning SEP of year 1
- Sequence construction activities to fit into 7 month off-season period (16 SEP- 14 MAY)
- Portion of park under construction closed during off-season
- Multiple crews working 8-10 hr days simultaneously at multiple locations
- Some activities use double-shift to fit facility replacement into 7 month window
- No high-use season impacts

TABLE 3
Option 5 Evaluation

Criteria	Result
Cost	Minimal revenue reimbursement 5 construction stop/start periods
Time	4 years, 8 months
Impacts	Phased recreational site closures

Strengths:

Minimal park revenue impacts

Low revenue reimbursement

Facilities available in high-use season

Weaknesses:

Long construction period

Longest option to begin storage

High const cost due to start/stop

Option 6: Combination of off-season and high-use season

- Construction duration nearly 3 years beginning SEP of year 1.
- Sequence construction activities to fit into 7 month off-season period (16 SEP- 14 MAY).
- North boat ramp, swim beach area and marina remain open during high-use season.
- Portion of park under construction closed during off-season.
- Multiple crews working 8-10 hr days simultaneously at multiple locations.
- Some activities use double-shift to fit facility replacement into 7 month window.
- Reconstruct smaller facilities (with alternate locations) during high-use season.

TABLE 4
Option 6 Evaluation

Criteria	Result
Cost	Moderate revenue reimbursement No construction stop/start
Time	2 years, 8 months
Impacts	Phased recreational site closures

Strengths:

Moderate revenue loss

Minimal revenue reimbursement

Efficient construction/lower cost

No loss of facilities for public use

North Ramp, Swim Beach and Marina remain open in high-use season

Weaknesses:

Visitor experience impacted during high-use season

Public safety near construction zones

TABLE 5
Option Comparison

Criteria	Option 2	Option 5	Option 6
Lost Revenue $ (low is good)	High	Low	Moderate
Construction Cost $ (low is good)	Low	High	Moderate
Public Impacts (low is good)	High	Low	Moderate
Public Safety (high is good)	High	Moderate	Low
Time (overall) (low is good)	Low 1 year, 8 months	High 4 years, 8 months	Moderate 2 years, 8 months

Summary of Analysis

After careful consideration of the factors influencing the use and operation of the park, several possible options were evaluated to determine the best construction concept to use that minimized impacts, cost and time.

Option 6, a combination of off-season and high-use season construction phasing is the Working Groups' recommended option. This construction did not exhibit extremes in impacts, time or cost, which other options had. The impacts that Option 6 exhibited were mostly moderate.

MEMORANDUM CH2MHILL

Assumed Productions Rates for Assembly of the Draft Schedule for Chatfield Reservoir Reallocation Study

TO: Rick McLoud, Fred Rios, Tom Browning, Dave Giger, Brooke Fox, Todd Wang

COPIES: File

FROM: Robert Pieper

DATE: January 16, 2009

The following are the assumption used during the review and scheduling of the Chatfield Reservoir Reallocation Study, Mitigation Plan Presentation, dated January 2009.

DEMOLITION

Item	Unit Qty	Notes
Clear & Grub	3 AC/day	
Remove Existing Asphalt Trail	400 LF/day	Assumed existing trial 8' wide
Remove Existing Conc. Trail	400 LF/day	Assumed existing trail 6' wide
Remove Existing Asphalt Pavement	10,000 SF/day	Rotomill and stockpiled

EARTHWORK

Item	Unit Qty	Notes
Bulk Embankment	1,800 cy/day	
Excavation	2,500 cy/day	Assuming no rock excavation
Hauling	2,500 cy/day	Assume haul = excavate
Rock Removal	0 cy/day	Assume no rock excavation
Top Soil	12,500 SF/day	
Fine Grading	125,000 SF/day	

ROADS AND PARKING

Item	Unit Qty	Notes
Asphalt	500 ton/day	
Stripping	8,000 LF/day	

Curb and Gutter	400 LF/day	

TRAILS

Item	Unit Qty	Notes
Concrete Trails	270 LF/day	8′ wide

UTILITIES

Item	Unit Qty	Notes
Water Line	400 LF/day	Assume trencher for service lines
Sanitary Sewer Lateral Line	200 lf/day	4″ to 12″ – low rate do to short runs
Sanitary Sewer Manhole	2 days/manhole	
Water Hydrants	1 day/ hydrant	
Lift Station	5 days/station	
Storm Water Inlets	2 days/inlet	
Storm Water Oil Separator Inlets	2 days /inlet	
Storm Water Pipe	200 LF/day	

ELECTRICAL and TELECOMMUNICATIONS

Item	Unit Qty	Notes
Electrical distribution	250 LF/day	Trencher, conduit, cable and termination
Telephone	250LF day	Assume the same length as electrical and run at the same time
Transformers	1 day/transformer	Set, anchor, pull and term wire
Light Poles	6 sets/day	Set, anchor, term and test

LANDSCAPE

Item	Unit Qty	Notes
Seeding – Dryland Grasses	250,000 SF/day	
Seeding – Irrigated Turf Grasses	30,000 SF/day	
Straw Mulch	250,000 SF/day	
Hydro Mulch	250,000 SF/day	
Deciduous Trees	10 trees/day	

Evergreen Trees	10 trees/day	
Shrubs	25 shrubs/day	

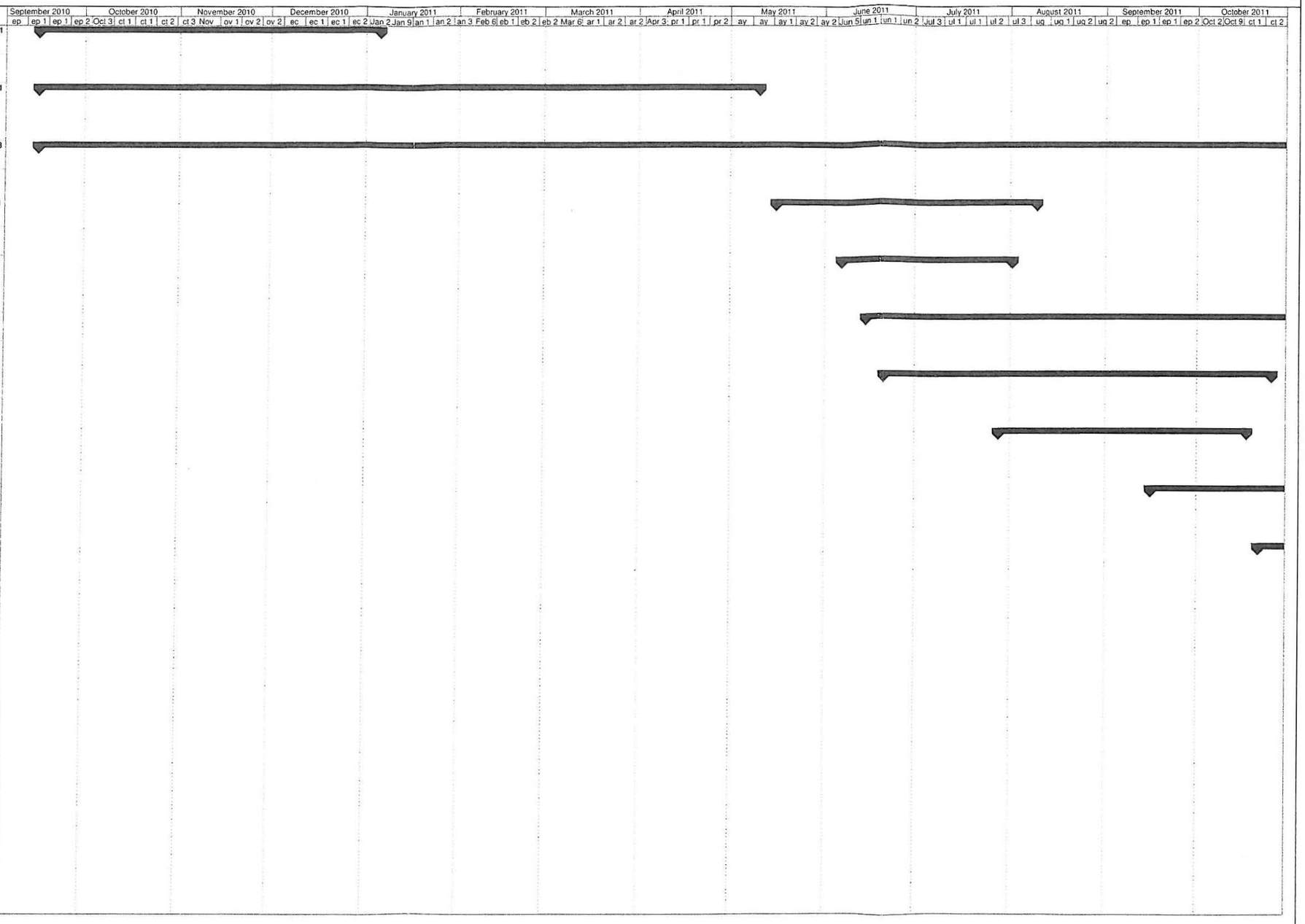
IRRIGATION

Item	Unit Qty	Notes
Point of Connection	3 day	Excavate, tap, backflow, test
Spray Irrigation	8000 SF/day	
Bubbler Irrigation	50 points/day	

GENERAL ASSUMPTIONS:

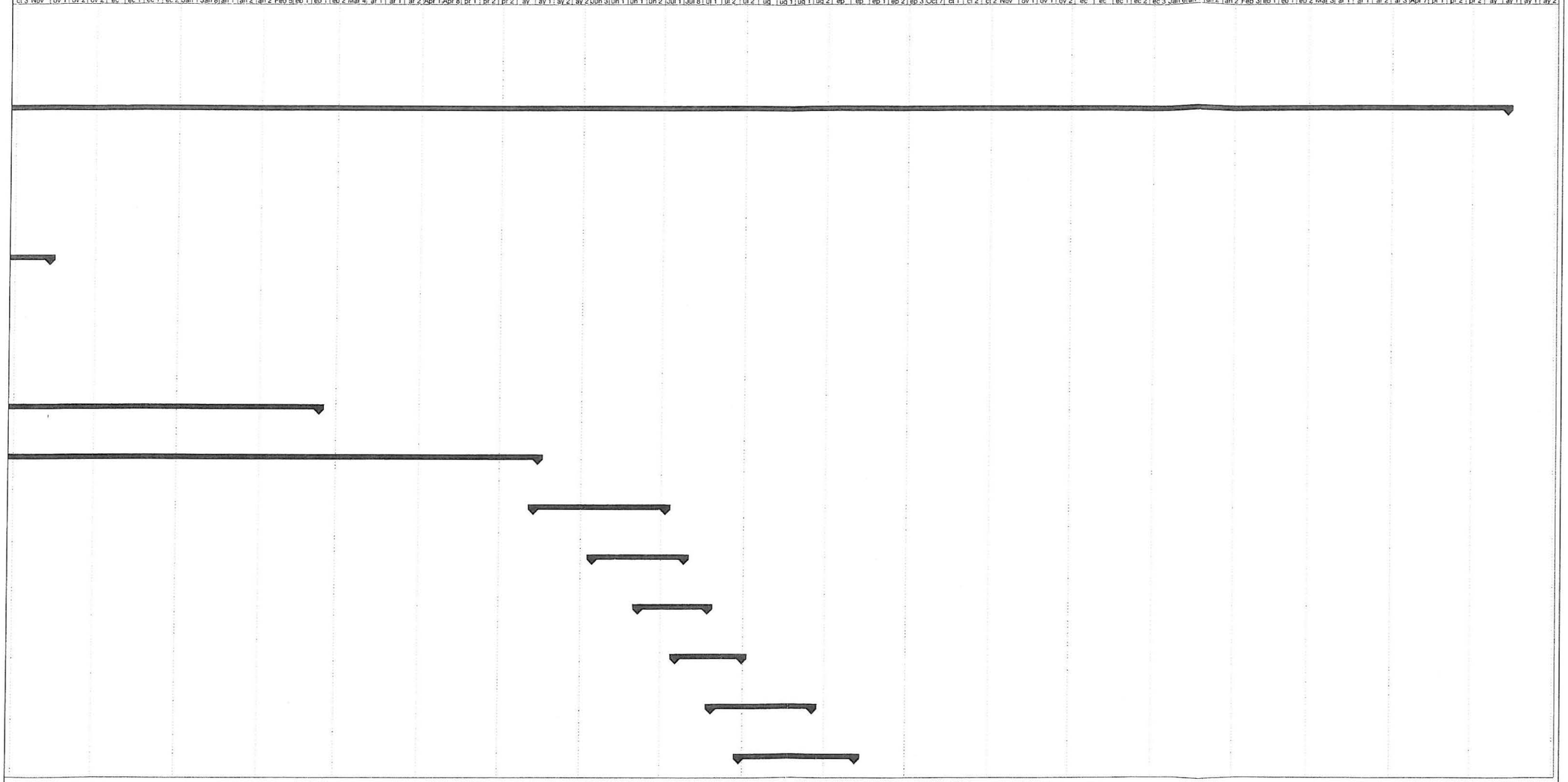
1. No Rock Excavation taken into account
2. No adverse weather days taken into account
3. Assume **ALL** excavated material is within the limits of the construction work for the project – no import from an off-site location is required.
4. Working Hours - Monday through Friday, 7:00 a.m. to 3:30 p.m. No OT or Weekend work incorporated in the schedule.
5.

ID	Task Name	Duration	Start	Finish
1	***NORTH RAMP***	90 days	Thu 9/16/10	Wed 1/5/11
43				
44	***SWIM BEACH***	195 days	Thu 9/16/10	Tue 5/10/11
159				
160	***MISCELLANEOUS WORK ITEMS***	804.63 days	Thu 9/16/10	Tue 5/14/13
11				
12	***MASSEY DRAW***	72 days	Mon 5/16/11	Tue 8/9/11
22				
23	***EAGLE COVE***	48 days	Mon 6/6/11	Mon 8/1/11
56				
57	***JAMISON***	128 days	Tue 6/14/11	Mon 11/14/11
31				
32	***DEER CREEK DAY USE/BALLOON LAUNCH AREA***	107 days	Mon 6/20/11	Tue 10/25/11
67				
68	***CATFISH FLATS - GROUP AREA 1 & 2***	67 days	Thu 7/28/11	Mon 10/17/11
121				
122	***MARINA POINT***	131 days	Fri 9/16/11	Thu 2/23/12
134				
135	***SOUTH RAMP including RIVERSIDE MARINA***	170 days	Fri 10/21/11	Tue 5/15/12
79				
80	***FOX RUN***	41 days	Mon 5/14/12	Mon 7/2/12
89				
90	***KINGFISHER AREA***	29 days	Tue 6/5/12	Mon 7/9/12
97				
98	***GRAVEL POND AREA***	21 days	Fri 6/22/12	Wed 7/18/12
105				
106	***PLATTE RIVER***	20 days	Fri 7/6/12	Tue 7/31/12
112				
113	***ROXBOROUGH COVE***	31 days	Fri 7/20/12	Mon 8/27/12
148				
149	***PLUM CREEK PICNIC AREA***	36 days	Mon 7/30/12	Wed 9/12/12

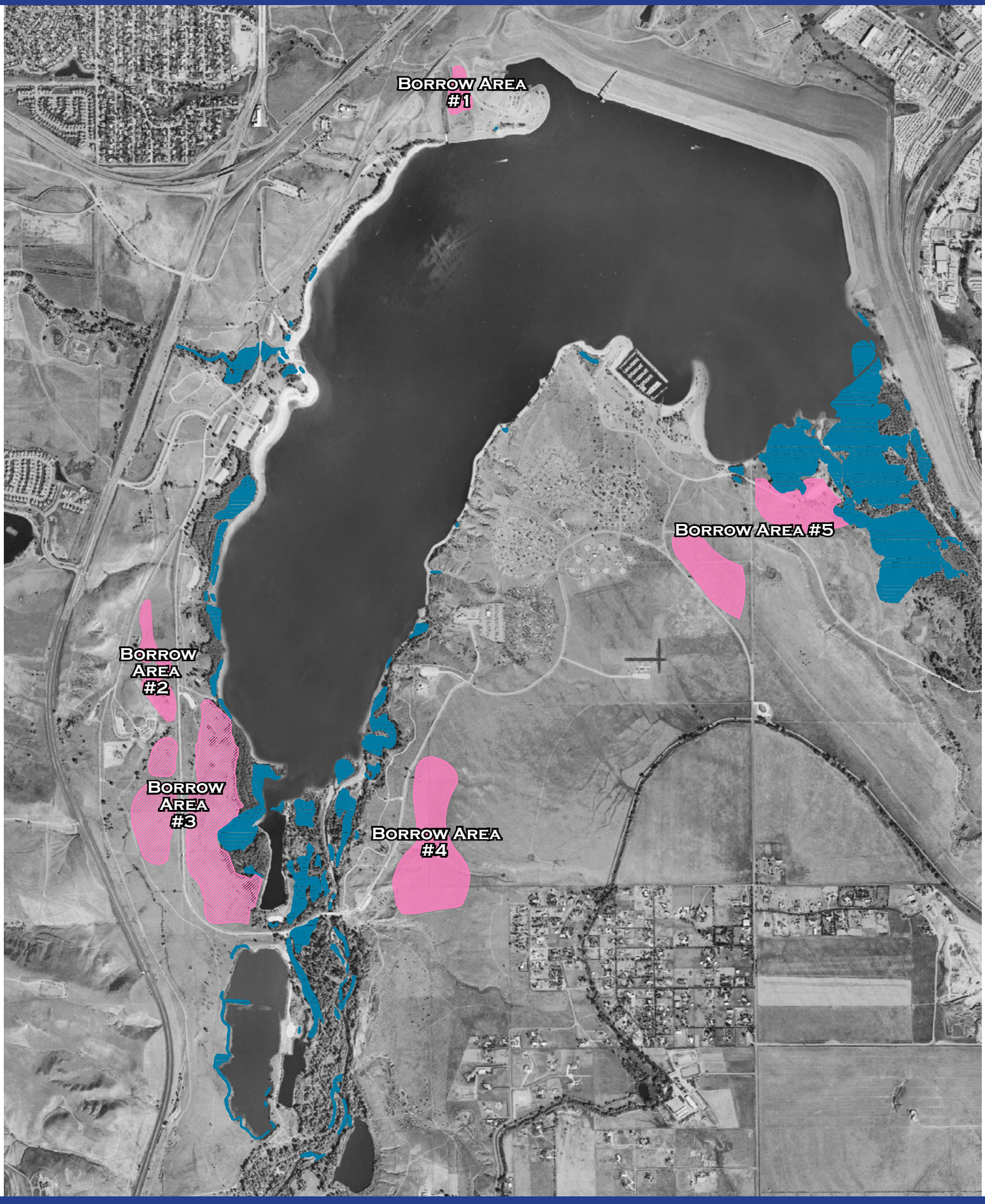


November 2011 | December 2011 | January 2012 | February 2012 | March 2012 | April 2012 | May 2012 | June 2012 | July 2012 | August 2012 | September 2012 | October 2012 | November 2012 | December 2012 | January 2013 | February 2013 | March 2013 | April 2013 | May 2013

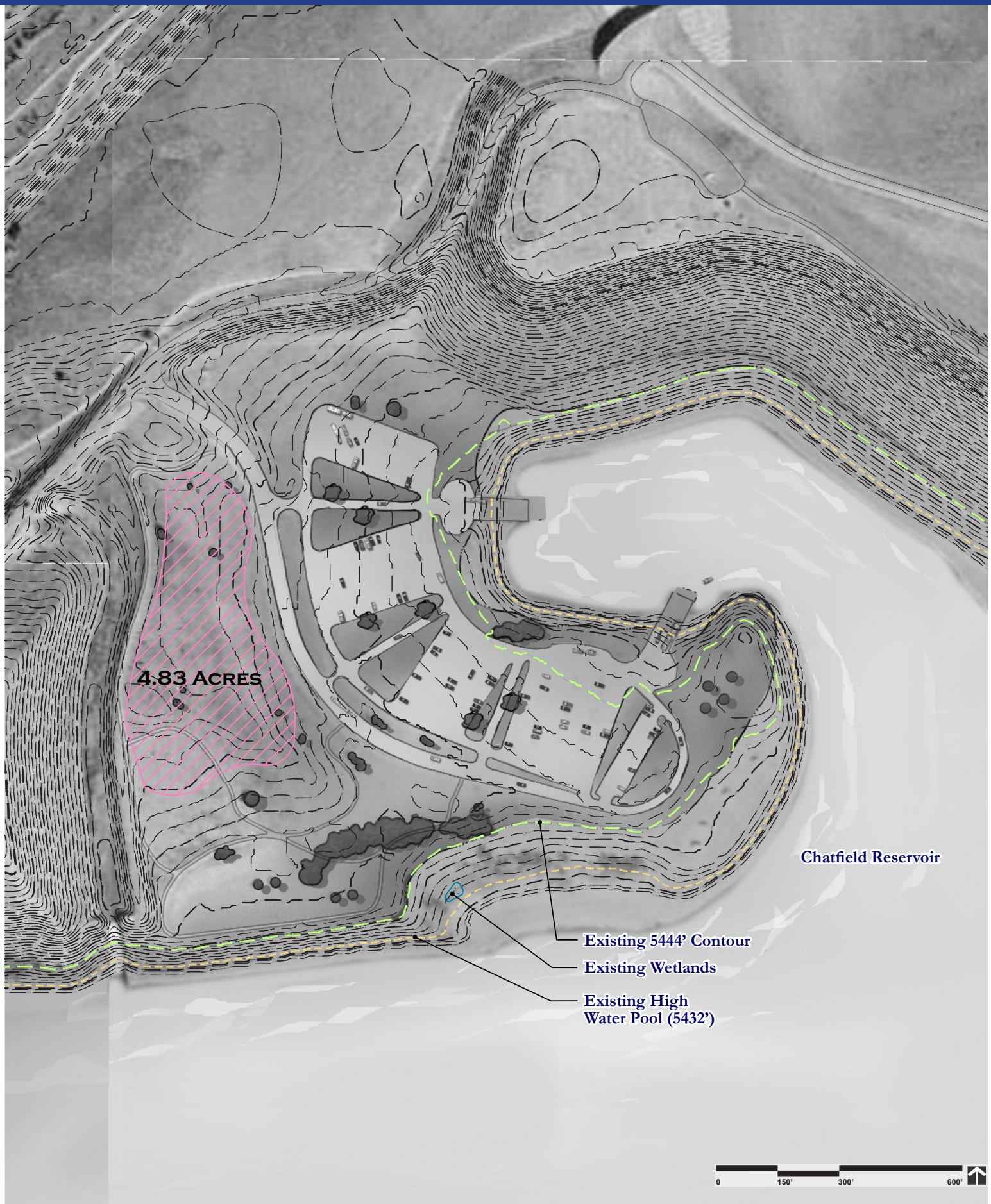
ct 3 Nov | ov 1 | ov 2 | ov 2 | ec | ec 1 | ec 1 | ec 2 | Jan 1 | Jan 8 | an 1 | an 2 | an 2 | Feb 5 | eb 1 | eb 1 | eb 2 | Mar 4 | ar 1 | ar 1 | ar 2 | Apr 1 | Apr 8 | pr 1 | pr 2 | pr 2 | ay | ay 1 | ay 2 | ay 2 | Jun 3 | un 1 | un 1 | un 2 | Jul 1 | Jul 8 | ul 1 | ul 2 | ul 2 | ug | ug 1 | ug 1 | ug 2 | ep | ep | ep 1 | ep 2 | ep 3 | Oct 7 | ct 1 | ct 2 | ct 2 | Nov | ov 1 | ov 1 | ov 2 | ec | ec | ec 1 | ec 2 | ec 3 | Jan 6 | an 1 | an 2 | an 2 | Feb 3 | eb 1 | eb 1 | eb 2 | Mar 3 | ar 1 | ar 1 | ar 2 | ar 3 | Apr 7 | pr 1 | pr 2 | pr 2 | ay | ay 1 | ay 1 | ay 2



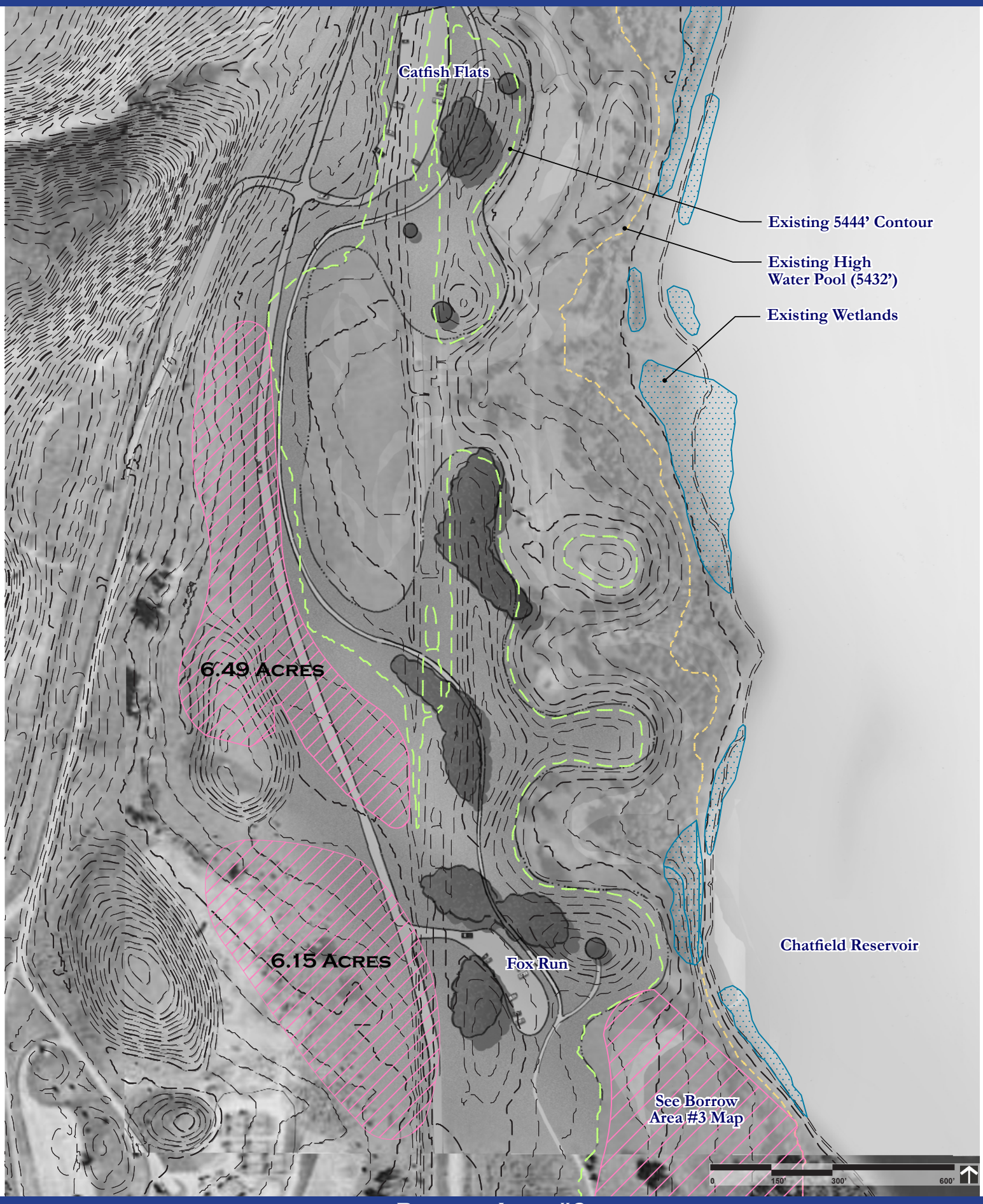
Appendix 8. Borrow Area Plans



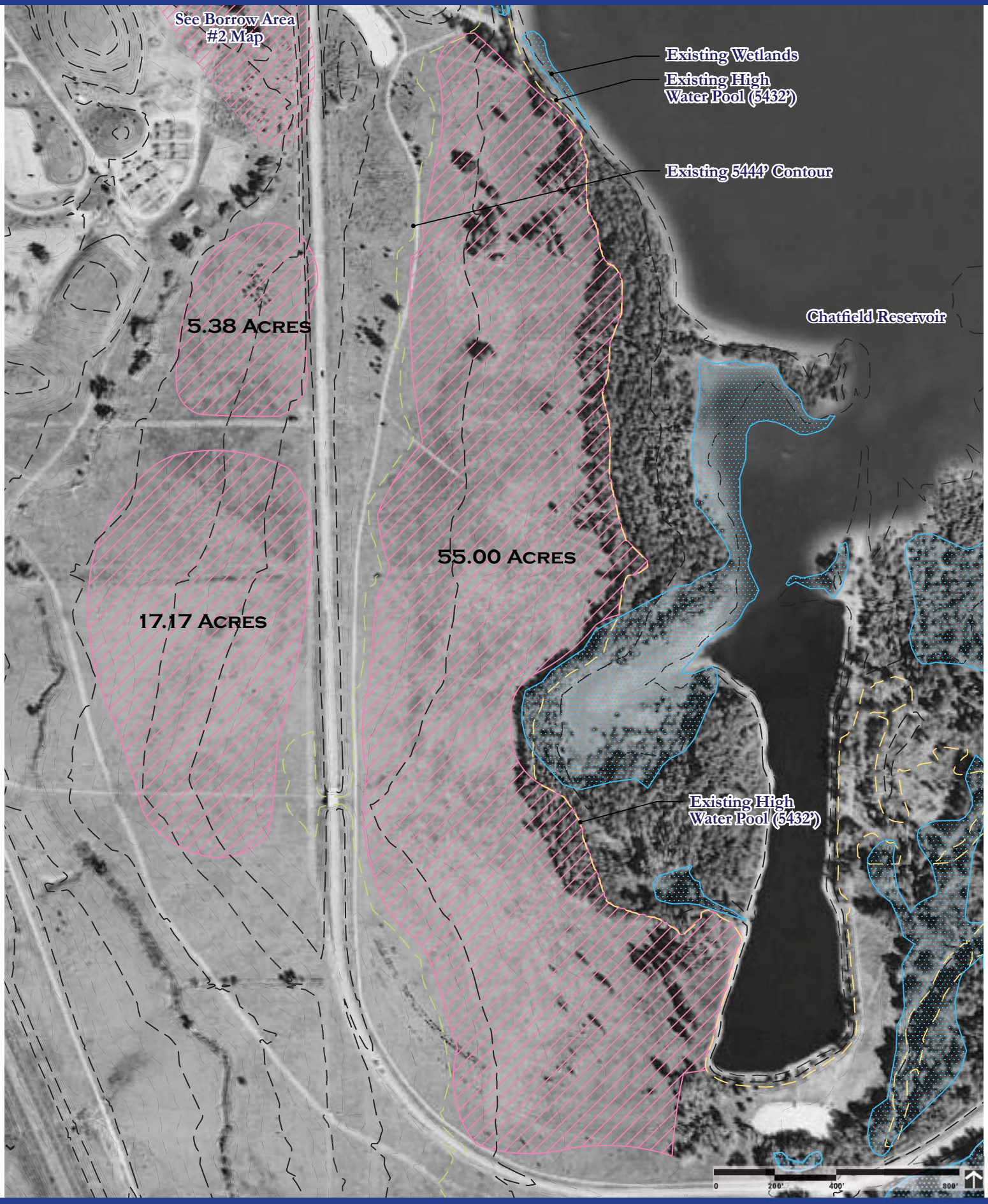
Overall Borrow Area Location Map



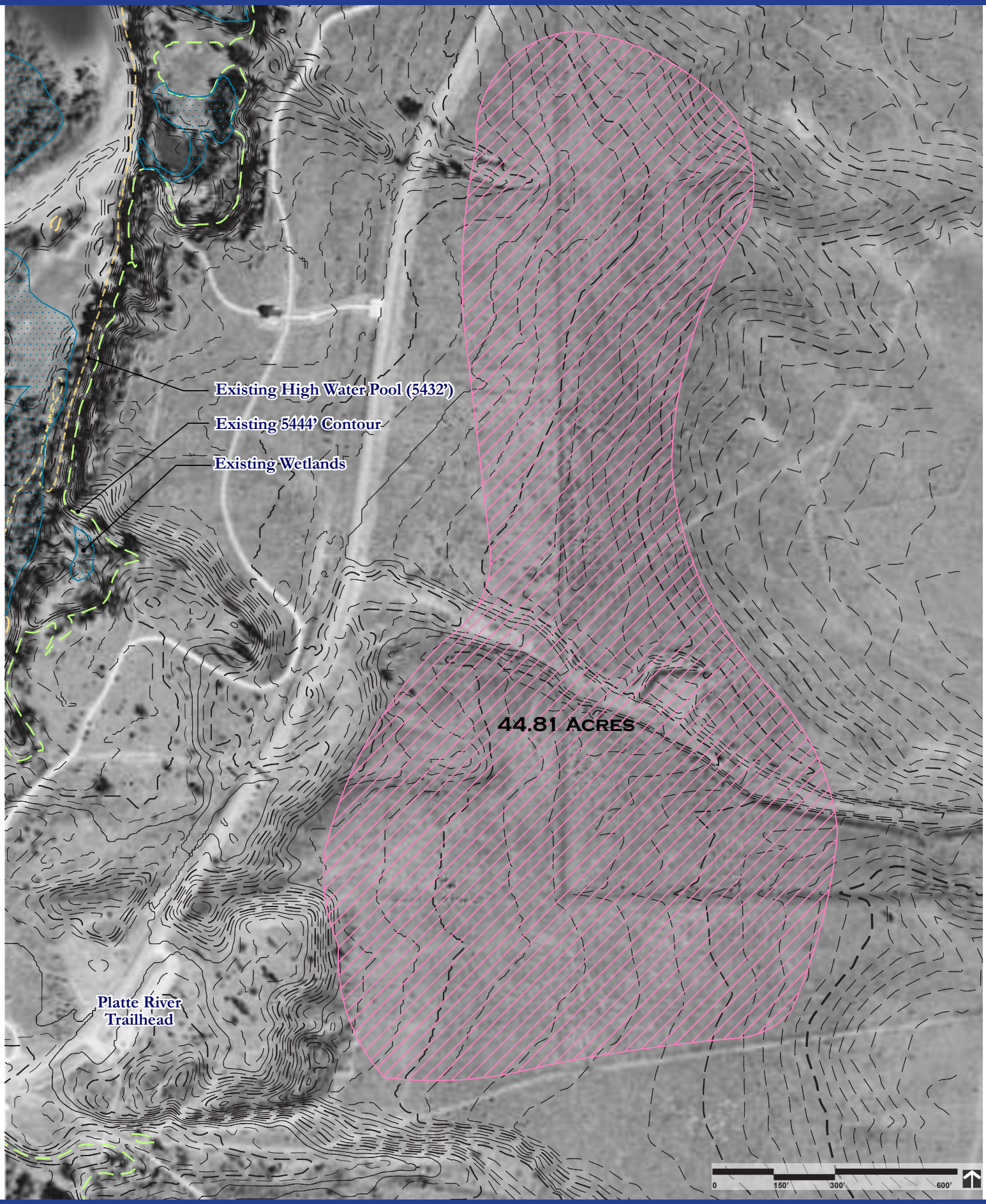
Borrow Area #1
North Boat Ramp



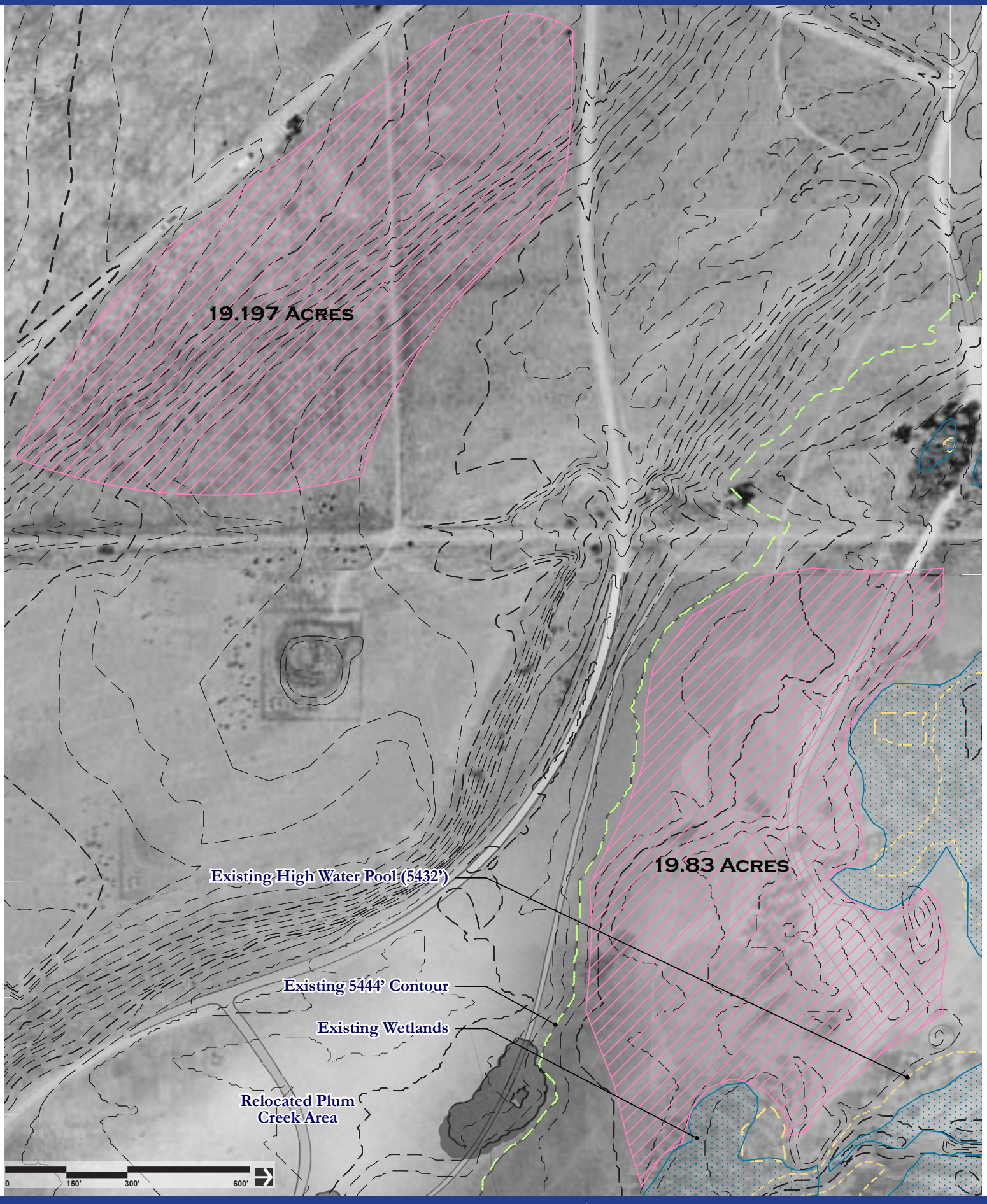
Borrow Area #2
Fox run



Borrow Area #3
North of Gravel Ponds



Borrow Area #4
Platte River Trailhead



Borrow Area #5
Plum Creek

Appendix 9. EarthCalc Summary

EARTHCALC INC.
EARTHWORK ESTIMATING • GPS • RENDERING

Modesto, CA
Newport Beach, CA
Portland, OR
Las Vegas, NV
Phoenix, AZ

Earthwork Summary

Project Name:	**CHATFIELD RESERVOIR**	Job Number:	**_090348**
Prepared for:	**EDAW INC**	Contact:	**Scott Sinn**
Prepared by:	**Keri Sheppard**	Client Ref#:	**_03030038.05**
Study Date:	**5/4/2009**	Plan Date:	

Construction Assumptions

Setbacks	**None**	Sections	**None**
Undercut	**None**		
Overbuilds	**None**		
Slab	**None**		
Notes			

Raw Earthwork

	Area (SF)			Raw Volumes (CY)		Raw		Balance
Region	**Total**	**Cut**	**Fill**	**Cut**	**Fill**	**Balance**		**Change\.1'**
Mass Grade	17,010,126	10,685,779	6,324,347	1,063,971	1,127,252	63,281	Import	63,000
Raw Total	**17,010,126**	**10,685,779**	**6,324,347**	**1,063,971**	**1,127,252**	**63,281**	**Import**	

Adjusted Earthwork

						Volume (cy)	Type
Raw Balance					(from above)	**63,281**	Import
Stripping	Depth(ft):	0.00	Area (sf):	17,010,126			
Demolition	Depth(ft):	0.00	Area (sf):	17,010,126			
Subsidence	Depth(ft):	0.00	Area (sf):	17,010,126			
Swell	0%	Cut					
Shrinkage	0%	Fill					
Over-ex	Depth(ft):	0.00	Area (sf):	17,010,126			
Spoils	None						
Other adjustments	None						
					Net Balance	**63,281**	**Import**

Phone 800.765.1717 Fax 866.653.0365 www.earthcalc.com earthcalc@earthcalc.com

Project Name:	**CHATFIELD RESERVOIR**	Job Number:	**_090348**
Prepared for:	**EDAW INC**	Contact:	**Scott Sinn**
Prepared by:	**Keri Sheppard**	Client Ref#:	**_03030038.05**
Study Date:	**5/4/2009**	Plan Date:	

Raw Earthwork

Region	Total	Area (SF) Cut	Fill	Raw Volumes (CY) Cut	Fill	Net Balance	Balance Change /.1'
Above Elevation 5444	0	0	0	420,495	384,915	35,580	Export
Below Elevation 5432	0	0	0	198,726	28,243	170,483	Export
Elevation 5444-5432	0	0	0	444,750	714,094	269,344	Import
Site Total	**0**	**0**	**0**	**1,063,971**	**1,127,252**	**63,281**	**Import**

Appendix 10. Geotechnical Report

CTL | THOMPSON INCORPORATED

BORROW FILL SOIL INVESTIGATION
CHATFIELD RESERVOIR
STORAGE REALLOCATION PROJECT
DOUGLAS AND JEFFERSON COUNTIES, COLORADO

Prepared For:

EDAW/AECOM
240 East Mountain Avenue
Fort Collins, Colorado 80524

Attention: Mr. Scott Sinn

Project No. DN44,189-115

November 16, 2009

1971 West 12th Avenue | Denver, Colorado 80204 | Phone: 303-825-0777 | Fax: 303-825-4252

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FIG. 1 – VICINITY MAP

FIG. 2 – SITE PLAN

FIGS. 3 THROUGH 7 – LOCATIONS OF EXPLORATORY BORINGS

APPENDIX A – SUMMARY LOGS OF EXPLORATORY BORINGS

APPENDIX B – LABORATORY TEST RESULTS

SCOPE

This report presents the results of our Borrow Fill Soil Investigation, a part of studies for Chatfield Reservoir Storage Reallocation Project (Reallocation Project), in Douglas and Jefferson Counties, Colorado. The purpose of this investigation was to explore the subsoil and ground water conditions at the borrow areas, perform laboratory testing to evaluate the general engineering properties of the fill materials, and to provide our opinions and recommendations regarding the suitability of the fill for the Reallocation Project. The scope was described in our Service Agreement (DN 09-0102R2) dated and revised February 26, 2009 and Contract Modification (DN 09-0102R2-CM) dated September 9, 2009.

This report was prepared from data developed during our field exploration, laboratory testing, engineering analysis, and our experience with similar conditions. A summary of conclusions is presented below, with a more detailed description of our findings and recommendations contained in this report.

SUMMARY OF CONCLUSIONS

1. **Subsoils found in our borings generally consisted of a thin cover of topsoil over clean to clayey sands and sandy clays to the maximum depth explored of 10 feet. We believe the sand and clay encountered in our test holes are suitable for use as structural and non-structural fill for the Reallocation Project.**

2. **Ground water was encountered during drilling in one test hole (TH-31) at a depth of 3 feet below the existing ground surface (elevation 5438). When the test holes were checked about two weeks after drilling, no ground water was present in any of the test holes. Ground water should not be encountered during excavation, except near test hole TH-31.**

3. **The sand is non-expansive or low swelling and a better fill material for supporting foundations, slabs-on-grade and pavements. The clay may have high plasticity and moderate to high swell potential. The potential swell of the clay fill can be reduced to low if the clay fill is moisture conditioned to moisture contents above optimum or mixed with the sand. The unconfined compressive strengths of the remolded, compacted clay fill samples were between 3,000 and 4,700 psf. Soil**

classifications and engineering properties of the sand and clay are presented in the report.

4. **We estimate an average shrinkage factor of about 10 percent for the borrow fill materials encountered in our test holes. Many factors affect the estimate of fill shrinkage and bulking factor. The fill shrinkage/bulking estimate can vary significantly. Variation of the estimate may be within ± 5 percent.**

PROPOSED FILL BORROW AREAS

The Reallocation Project is to study the feasibility of reallocating a portion of flood control storage to other uses, including water supply for surrounding communities. Five potential borrow areas were identified by EDAW and their locations are shown on Fig. 2. Borrow Area #1 is located west of the North Boat Ramp, Borrow Area #2 is located north of the Horse Stables and west of Catfish Flats, Borrow Area #3 is located south of the Horse Stables and Fox Run and to the northwest of the Gravel Ponds, Borrow Area #4 is located northeast of the Gravel Ponds, and Borrow Area #5 is located east of the Campground, near the east entrance station and Plum Creek picnic area. These borrow areas have varying topographic conditions including flat ground, drainage channel, depression, local knob, and rolling hill. Existing ground surface contours are shown on Figs. 3 through 7. The ground is covered with native grasses, weeds and some trees.

INVESTIGATIONS

We were provided with both existing and proposed contours of the fill borrow areas from EDAW. Based on the differences of the existing and proposed site contours, we estimated cut depths at each test hole to determine the depths of the test holes. In some borrow areas, the proposed cuts are less than 5 feet. We were requested to drill test holes at least 5 feet deep based on the consideration that the topsoil needs to be removed and stockpiled for re-vegetation of the borrow areas after the fill is excavated.

Prior to our drilling, Aztec Consultants staked and surveyed the test holes on the sites, and provided us the staked test hole elevations. The test hole elevations surveyed by Aztec varied from the elevations of the test holes estimated from the site plan prepared by EDAW. We were informed by EDAW that their site plans were prepared based on the two-foot interval contours of USGS mapping and were less accurate than Aztec's field survey. EDAW suggested we use the test hole elevations provided by Aztec to determine boring depths.

Subsurface conditions at the fill borrow areas site were investigated by drilling 34 exploratory borings at the approximate locations shown on Figs. 3 through 7. The borings were drilled on September 29 and 30, 2009 with a truck-mounted drill rig via the access and egress routes approved by representatives of Chatfield State Park. The borings were drilled to depths of 5 to 10 feet and samples of subsoils were obtained by using California drive and thin-walled, Shelby tube samplers. Bulk samples of different soil types were also collected from auger cuttings. A representative of our firm observed drilling operations, obtained samples, and logged the subsoils encountered. Slotted PVC pipe was installed in selected test holes to allow ground water measurement after drilling. Summary logs of the soil found in our borings, field penetration resistance test results, and a portion of the laboratory data are presented in Appendix A.

Soil samples obtained during drilling were returned to our laboratory and visually examined by our geotechnical engineer. Laboratory testing was then assigned and included moisture content and dry density, swell/consolidation, gradation, Atterberg Limits, Proctor compaction, unconfined compression, pH, resistivity and water-soluble sulfate content. These tests were performed on natural and remolded samples. Results of the laboratory tests are presented in Appendix B and summarized on Table B-I.

SUBSURFACE CONDITIONS

Subsoils found in our borings generally consisted of a thin cover of topsoil over clean to clayey sands and sandy clays to the maximum depth explored of 10 feet. The subsoils in each borrow area and their pertinent engineering characteristics are described in the following paragraphs.

Borrow Area #1

Four test holes (TH-1 through TH-4) were drilled in Borrow Area #1 at the locations shown on Fig. 3. Slightly silty to clayey sand was encountered to the maximum depth explored. About 4 to 5 inches of topsoil was encountered at the ground surface. The sand was medium dense to very dense based on the field penetration resistance test results. The sand samples had 7 to 36 percent silt and clay sized particles (passing the No. 200 sieve). No ground water was encountered in test holes during or after drilling.

Borrow Area #2

Five test holes (TH-5 through TH-9) were drilled in Borrow Area #2 (Fig. 4). Sandy clay and slightly silty to clayey sand were encountered in test holes. About 4 to 8 inches of topsoil was encountered at the ground surface. The clay was very stiff and the sand was loose to medium dense based on the field penetration resistance test results. The sand and clay samples had 7 to 38 percent and 79 to 100 percent silt and clay sized particles (passing the No. 200 sieve), respectively. The clay exhibited high plasticity with liquid limits of 57 and 59 percent and plasticity indices of 32 and 41 percent. A clay sample had a water-soluble sulfate concentration of 0.05 percent. No ground water was encountered in test holes during or after drilling.

Borrow Area #3

Eight test holes (TH-10 through TH-17) were drilled in Borrow Area #3 (Fig. 5). Sandy clay, clayey sand and interlayered clay and sand were encountered in test holes. About 0 to 10 inches of topsoil was encountered at the ground surface. Two clay was medium stiff to very stiff and the sand was loose to medium dense. The sand samples had 33 and 34 percent silt and clay sized particles (passing the No. 200 sieve). Clay samples has 57 to 97 percent fines and exhibited low to high plasticity with liquid limits of 22 to 63 percent and plasticity indices of 5 to 44 percent. Two clay samples has 0.03 percent soluble sulfate. No ground water was encountered in test holes during or after drilling.

Borrow Area #4

Eleven test holes (TH-18 through TH-28) were drilled in Borrow Area #4 (Fig. 6). Clean to clayey sand, sandy clay, and interlayered clay and sand were encountered in test holes. The sand is predominant soil encountered. About 0 to 10 inches of topsoil was encountered at the ground surface. The clay was stiff to very stiff and the sand was loose to medium dense. Sand samples contained 2 to 37 percent silt and clay sized particles. One sample had a water-soluble sulfate concentration of 0.05 percent. No ground water was encountered in test holes during and after drilling.

Borrow Area #5

Six test holes (TH-29 through TH-34) were drilled in Borrow Area #5 (Fig. 7). Clean, silty, and clayey sand were encountered in test holes. About 4 to 6 inches of topsoil was encountered at the ground surface. The sand was very loose to dense. The sand samples had 3 to 34 percent fines (passing the No. 200 sieve). Very loose sand was encountered in test hole TH-31 at depths of 3 to 5 feet. Ground water was encountered in TH-31 at a depth of 3 feet during drilling, but was not found when the hole was checked after drilling. TH-31caved at a depth of 4 feet after drilling. Ground water was not encountered in other test holes during or after drilling.

ENGINEERING PROPERTIES OF BORROW SOILS

Clean, silty and clayey sand and sandy clay are present in the upper 5 to 10 feet of the fill borrow areas. In general, the sand is non-expansive or low swelling soil. We believe the sand is a better fill material for supporting foundations, slabs-on-grade and pavements. The clay is low to high plasticity and may exhibit low to high swell potential depending upon the moisture and density of the clay fill. Based on our experience, the swell potential of the clay can be reduced to low if the clay fill is moisture conditioned to above optimum moisture content during placement.

We have grouped the sand, clay, and mixed clay and sand samples and performed laboratory tests including as standard Proctor compaction, swell/consolidation, strength and other engineering properties. The Proctor compaction test results are presented on Figs. B-1 through B-3 in Appendix B. We remolded combined clay samples to about 95 percent of the standard Proctor maximum dry densities (as determined using ASTM D 698 test procedures) at moisture contents at or above the optimum moisture contents. Swell/consolidation tests performed on remolded clay samples showed low measured swell (between 0.1 and 1.2 percent) after wetting under applied pressures of 200, 500 and 1,000 psf (Figs. B-4 through B-9 in Appendix B). The unconfined compressive strengths of the remolded clay samples were between 3,000 psf and 4,700 psf. We also performed pH, sulfate and resistivity tests on the combined samples of clay, sand and mixed clay and sand. The test results are presented on Table B-I in Appendix B.

SITE DEVELOPMENT

Excavation

The sand and clay encountered in our test holes can be excavated with heavy-duty excavation equipment. We do not anticipate rock excavation or blasting will be required. Excavation sides will need to be sloped to meet local, state and federal safety regulations, or be retained. The clay will likely classify as Type B or Type C soil

and the sand will likely classify as Type C soil based according to OSHA standards. Type B soil requires a maximum slope inclination of 1:1 (horizontal to vertical) and Type C requires 1.5:1 for temporary excavations in dry conditions. Flatter slopes will be required where excavations encountered water. The contractor should review excavation conditions when worker exposure is anticipated, identify the soils encountered in excavations and refer to OSHA standards to determine the appropriate slopes. Contractors are responsible to provide safe and stable excavations.

The excavation in the vicinity of TH-31 may encounter ground water. Excavation should be sloped such that ground water and surface water from precipitation can drain to a positive gravity outfall or to temporary sumps where water can be removed by pumping, if necessary. Where excavations encounter soft and/or loose soils, the bottom of the excavations should be stabilized by crowding 1.5 to 6-inch nominal diameter crushed rock into the soft/loose soils. Placement of filter fabric between the soft/loose soils and crushed rock may result in reduced thickness of rock needed to stabilize the base of the excavations. Ground water and very soft or loose soils may be encountered in the area of test hole TH-31.

Fill Placement

The soils encountered in the our test holes are suitable for use as fill material provided that vegetation, debris and other deleterious materials are substantially removed. Prior to fill placement, vegetation and topsoil should be removed. Areas to receive fill should be scarified to 8 to 12 inches, moisture conditioned and compacted the criteria in the following paragraph.

The properties of the fill will affect the performance of foundations, embankments, slabs-on-grade, pavements and other improvements. Fill should be placed in thin, loose lifts (8 inches or less) and compacted to at least 95 percent of standard Proctor maximum dry density (ASTM D 698) for clay fill or modified Proctor maximum dry density (ASTM D 1557) for sand fill. Granular fill should be moistened

to within 2 percent of optimum moisture content. Clay fill should be moistened between optimum and 3 percent above optimum moisture content. Placement and compaction of fill and backfill should be observed and tested by a qualified geotechnical engineer and an owner's representative during construction.

FILL SHRINKAGE AND BULKING

The shrinkage or bulking of the fill was estimated based on the natural dry densities of the subsoils in the borrow areas and the dry densities of the compacted fill. A total of 29 clay samples and 53 sand samples were tested for the moisture content and dry density during our investigation. Bulk samples of the clay and sand were grouped. Standard Proctor compaction test results (ASTM D 698), are shown on Figs. B-1 through B-3 (Appendix B). Based on our experience, we assumed the fill will be compacted to between 95 and 100 percent of the maximum dry densities with an average of 97 percent. We estimated approximately 65 percent of the fill will consist of sand and 35 percent of the fill will consist of clay. Based on data obtained from our field and laboratory investigations, the theoretical analysis indicated a shrinkage factor of the clay fill of about 6 percent and a shrinkage factor of the sand fill of about 12 percent. Our calculations indicate an average shrinkage of about 10 percent for the five borrow areas investigated.

Many factors affect the estimate of fill shrinkage-bulking factor. These factors include varying subsoil conditions, sample disturbance, varying compaction curves of different fill materials, overbuilds of slopes, stripping, over-compaction, wasting of material and practical factors associated with grading. The weight of the fill can cause compression of the underlying loose or soft natural soils in the fill areas. Our experience indicated the fill shrinkage/bulking estimate can vary significantly. The variation of the estimated shrinkage factor is likely ± 5 percent.

LIMITATIONS

The borings were widely spaced to obtain a general picture of the subsoil conditions within the proposed borrow areas. Variations in the subsoil conditions not indicated by our borings are always possible.

We believe this investigation was conducted with that level of skill and care normally used by geotechnical engineers practicing in this area at this time. No warranty, express or implied, is made. If we can be of further service in discussing the contents of the report, or in the analysis of the influence of the subsurface conditions on the proposed construction, please call.

CTL | THOMPSON, INC.

COLORADO REGISTERED NAN PING HSIEH 22924 11/16/09 PROFESSIONAL ENGINEER

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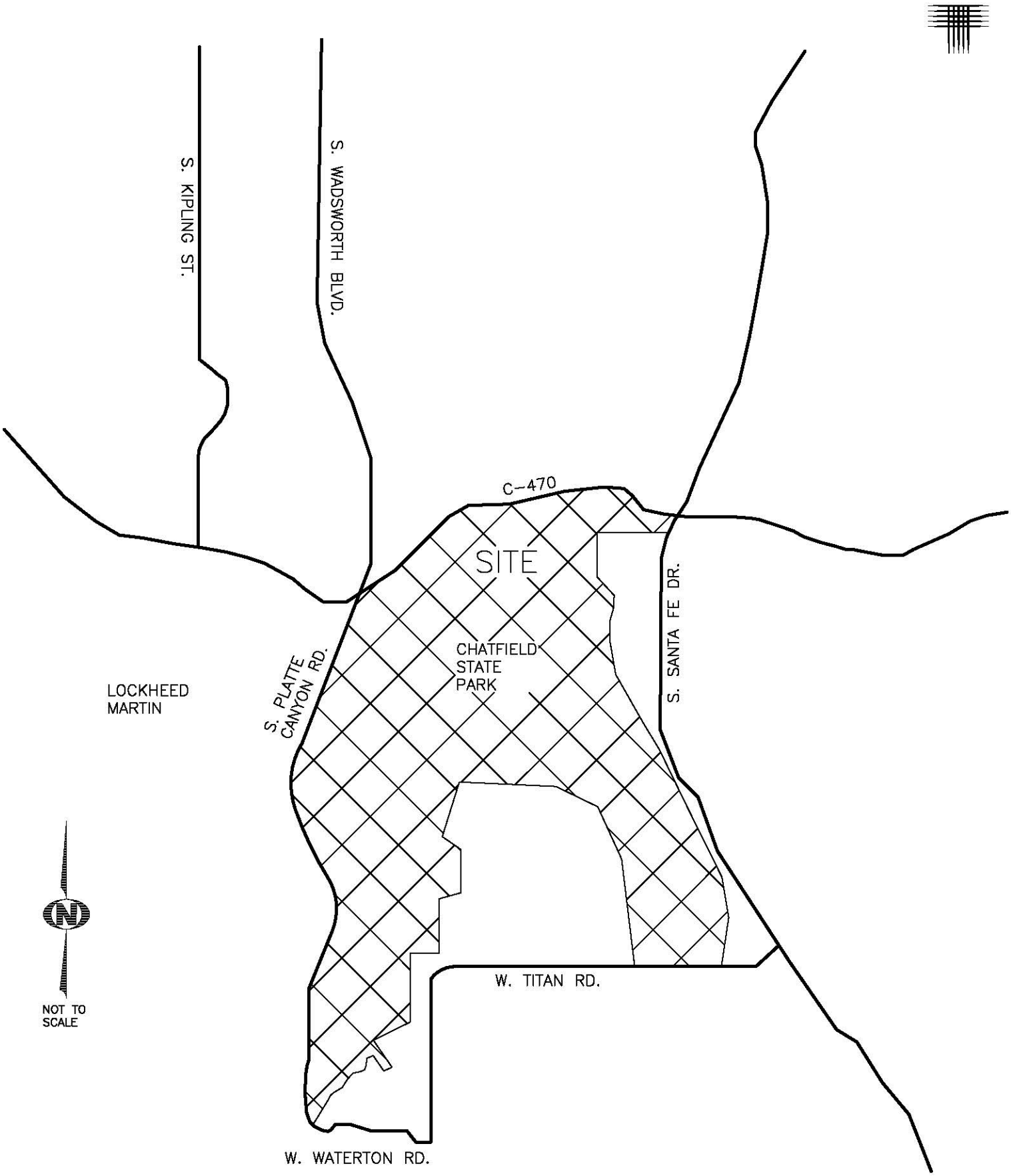

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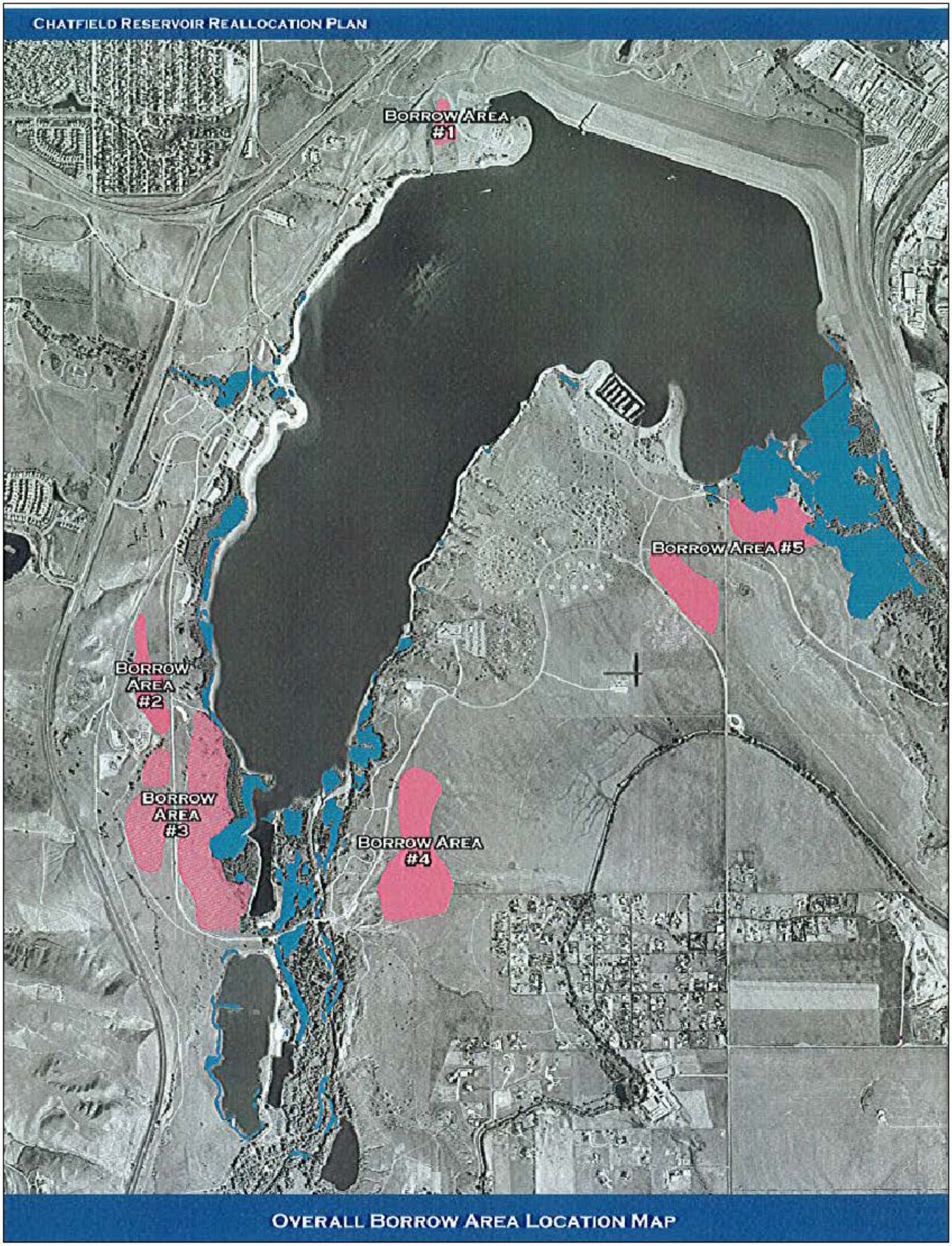
Project No. DN44,189-115

Vicinity Map **Fig. 1**



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NOT TO SCALE

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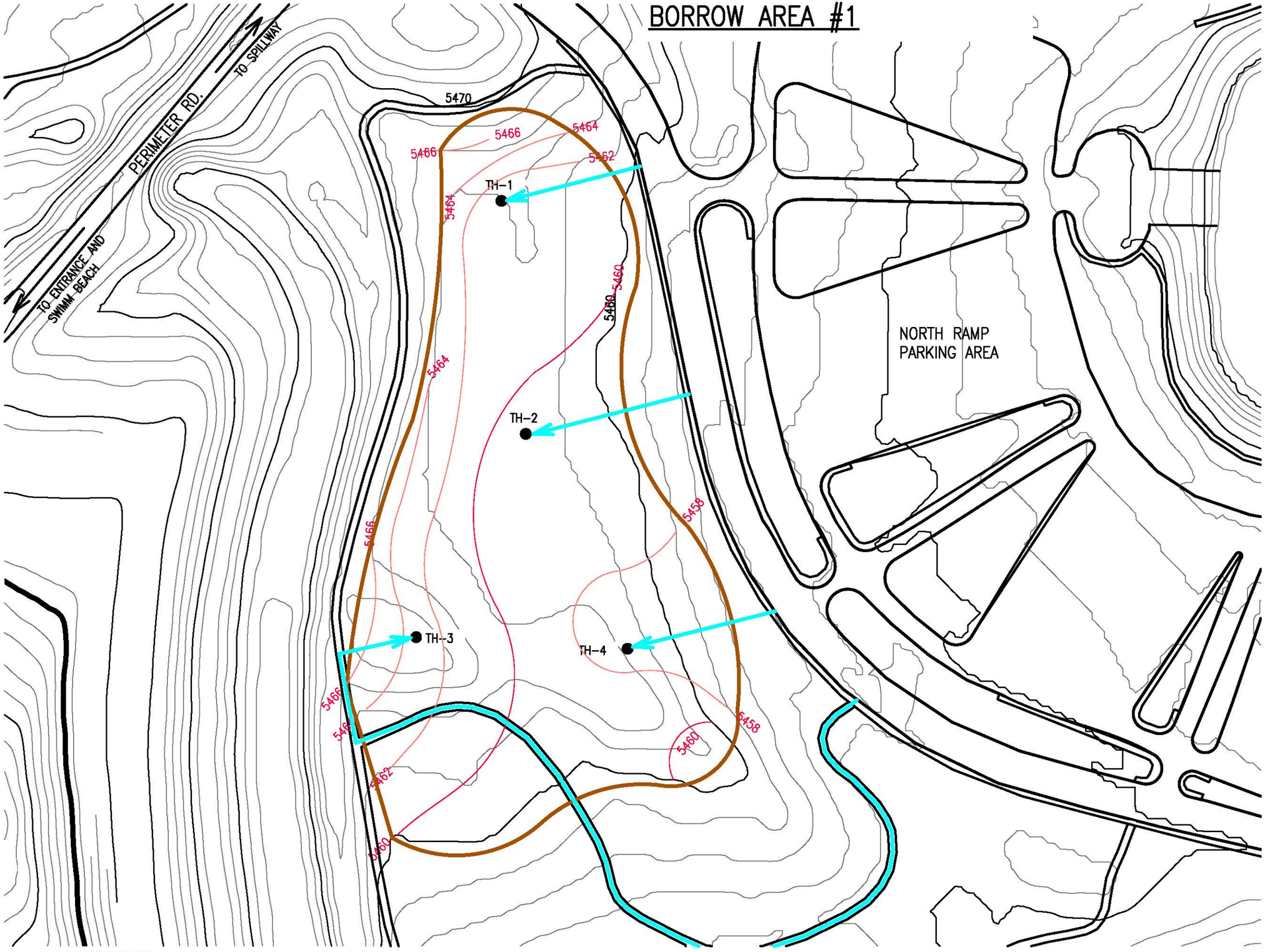
Site Plan **Fig. 2**

BORROW AREA #1



0 50 100

SCALE: 1" = 100'

LEGEND:

- TH-1 ● APPROXIMATE LOCATION OF EXPLORATORY BORING
- 5470 INDICATES EXISTING GROUND SURFACE ELEVATION (FEET)
- 5460 INDICATES PROPOSED GROUND SURFACE ELEVATION (FEET)
- INDICATES ACCESS/EGRESS ROUTE

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Locations of Exploratory Borings **Fig. 3**

BORROW AREA #2

LEGEND:

TH-5 ● APPROXIMATE LOCATION OF EXPLORATORY BORING

5450 INDICATES EXISTING GROUND SURFACE ELEVATION (FEET)

5450 INDICATES PROPOSED GROUND SURFACE ELEVATION (FEET)

INDICATES ACCESS/EGRESS ROUTE

0 100 200

SCALE: 1" = 200'

HORSE STABLES

TH-5

TH-6

TH-7

TH-8

TH-9

5440 5446 5448 5450 5452 5454 5456 5458 5460 5462

TO SWIM BEACH AND ENTRANCE

FOX RUN

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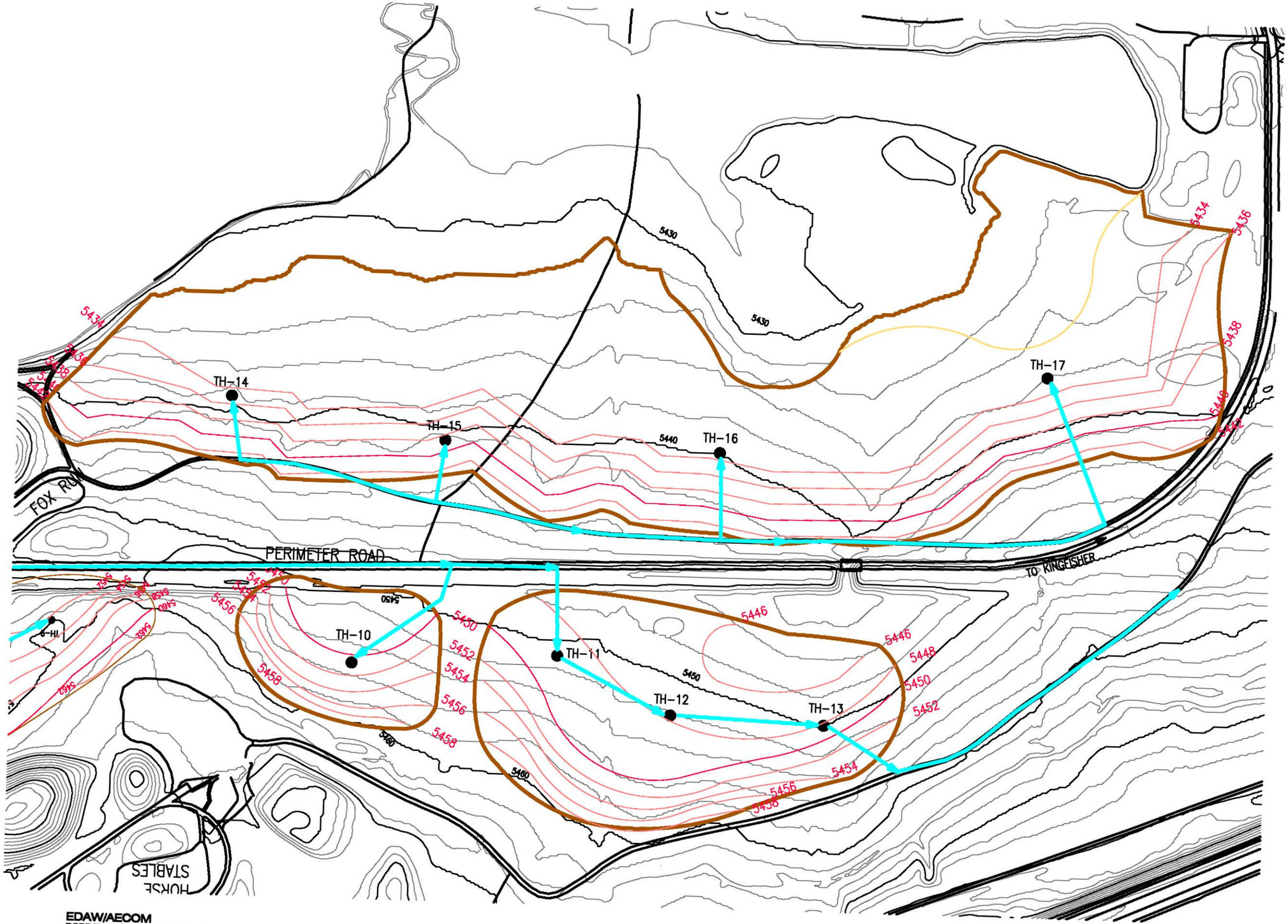
Locations of Exploratory Borings

Fig. 4

BORROW AREA #3



LEGEND:

- TH-10 — APPROXIMATE LOCATION OF EXPLORATORY BORING
- 5492 — INDICATES EXISTING GROUND SURFACE ELEVATION (FEET)
- 5440 — INDICATES PROPOSED GROUND SURFACE ELEVATION (FEET)
- INDICATES ACCESS/EGRESS ROUTE

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Locations of Exploratory Borings

Fig. 5

BORROW AREA #4

LEGEND:

TH–18 ● APPROXIMTE LOCATION OF EXPLORATORY BORING

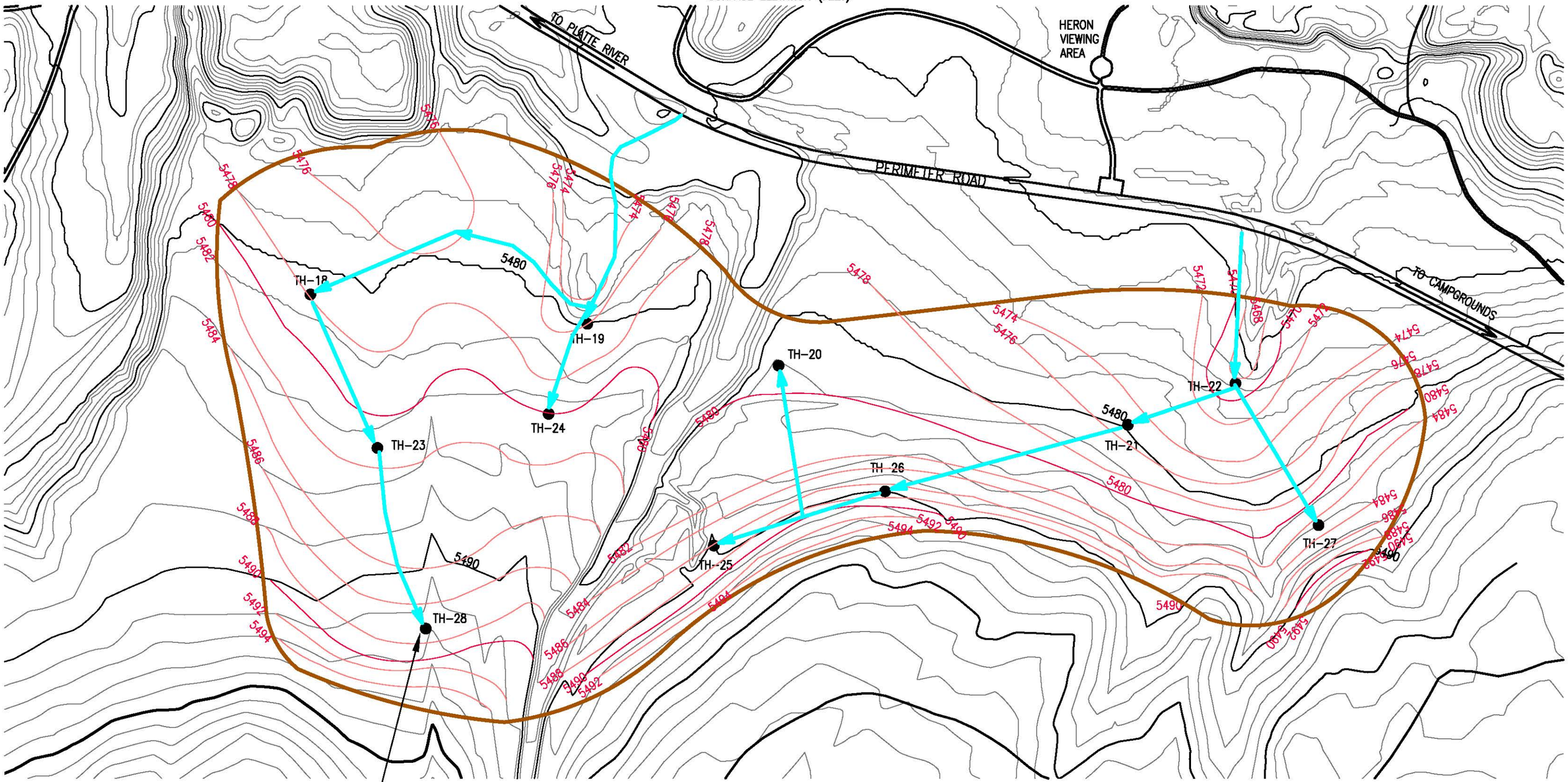
5480 INDICATES EXISTING GROUND SURFACE ELEVATION (FEET)

5480 INDICATES PROPOSED GROUND SURFACE ELEVATION (FEET)

INDICATES ACCESS/EGRESS ROUTE

0 100 200

SCALE: 1" = 200'



NOTE: TH–28 MOVED 15.5' TO SOUTHWEST

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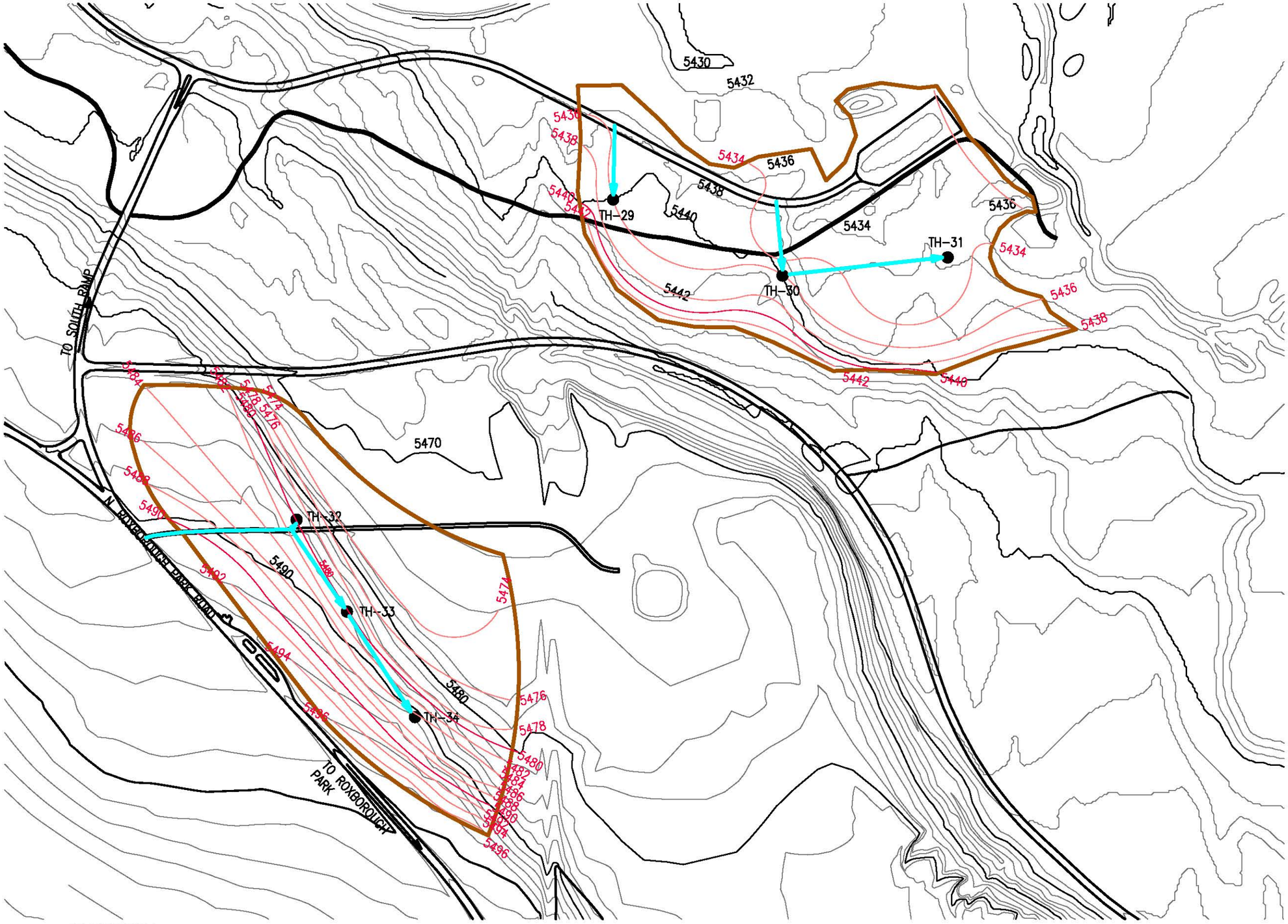
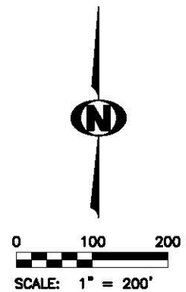
Locations of Exploratory Borings

Fig. 6

BORROW AREA #5





LEGEND:

- TH–29 ● APPROXIMATE LOCATION OF EXPLORATORY BORING
- 5492 INDICATES EXISTING GROUND SURFACE ELEVATION (FEET)
- 5440 INDICATES PROPOSED GROUND SURFACE ELEVATION (FEET)
- INDICATES ACCESS/EGRESS ROUTE

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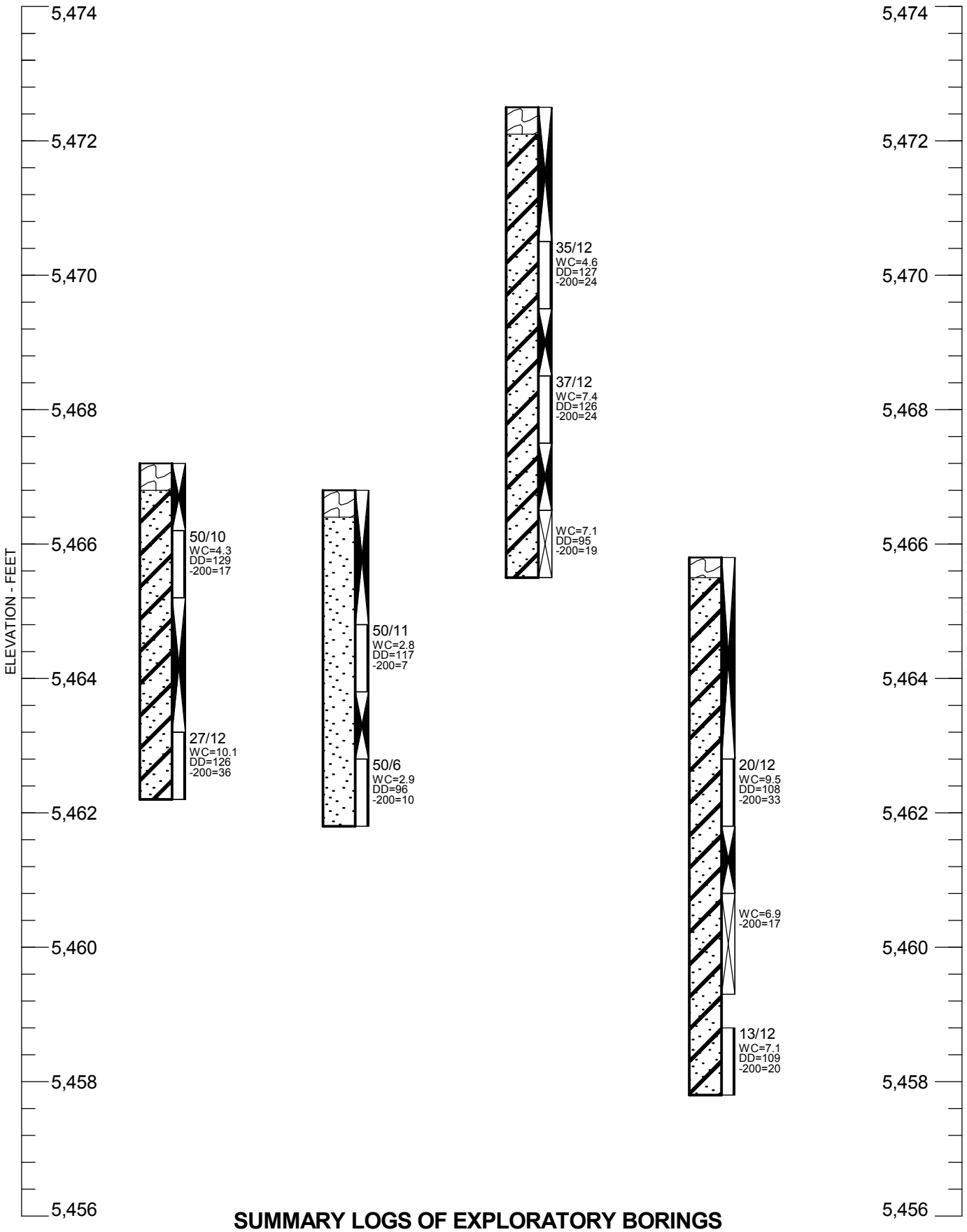
Locations of Exploratory Borings **Fig. 7**

APPENDIX A

SUMMARY LOGS OF EXPLORATORY BORINGS

BORROW AREA #1



SUMMARY LOGS OF EXPLORATORY BORINGS

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FIG. A- 1

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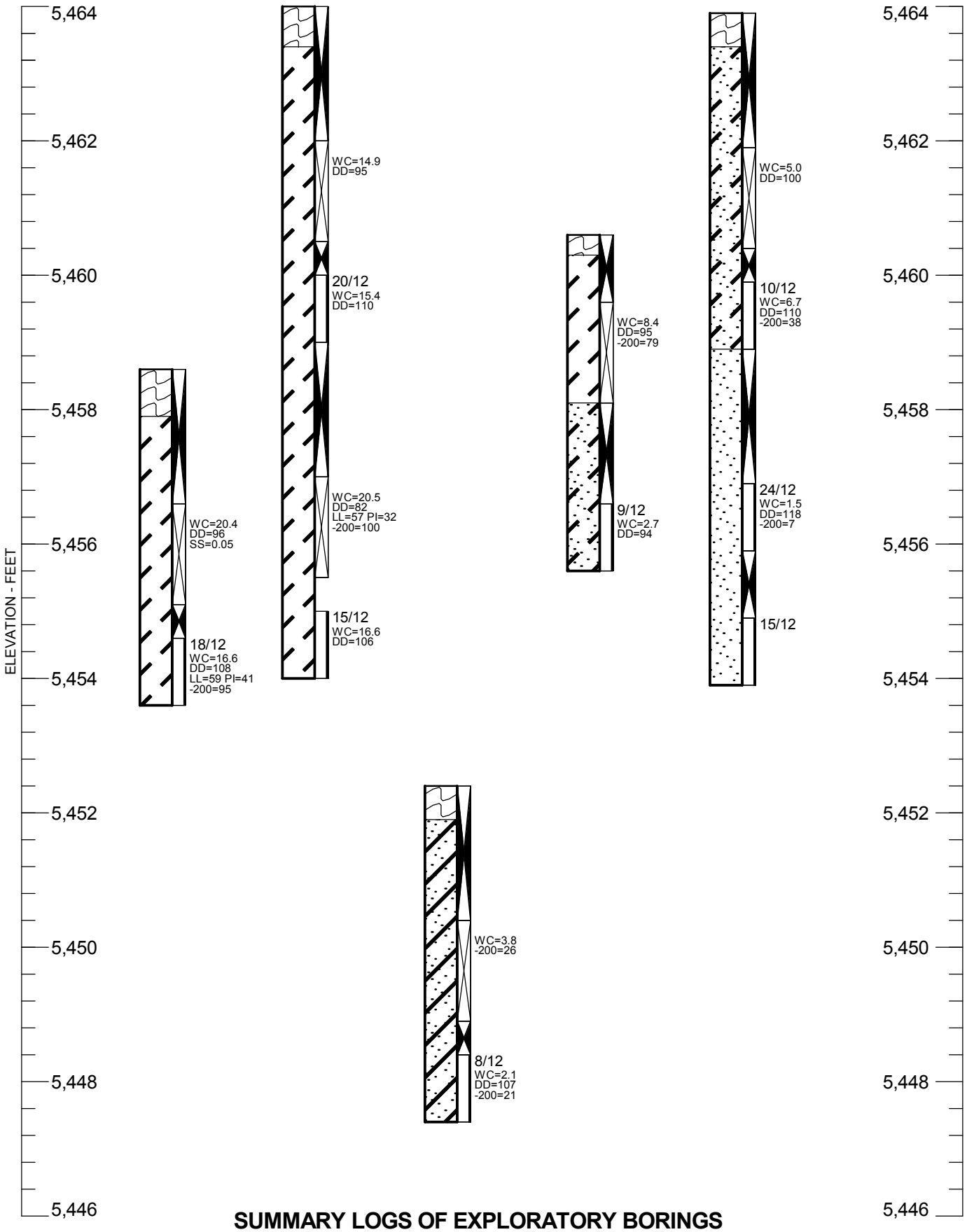
BORROW AREA #2



SUMMARY LOGS OF EXPLORATORY BORINGS

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FIG. A- 2

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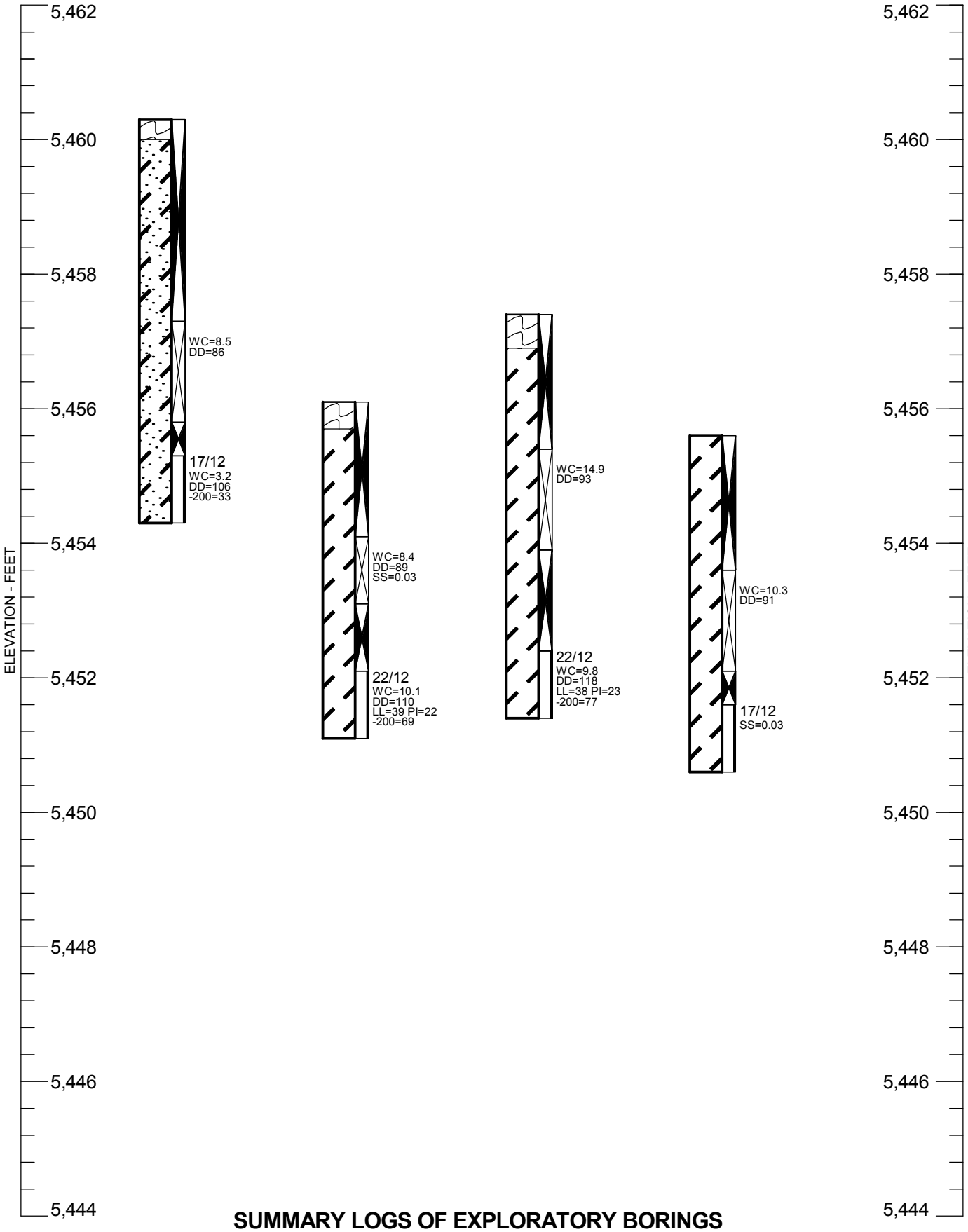
BORROW AREA #3



SUMMARY LOGS OF EXPLORATORY BORINGS

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FIG. A- 3

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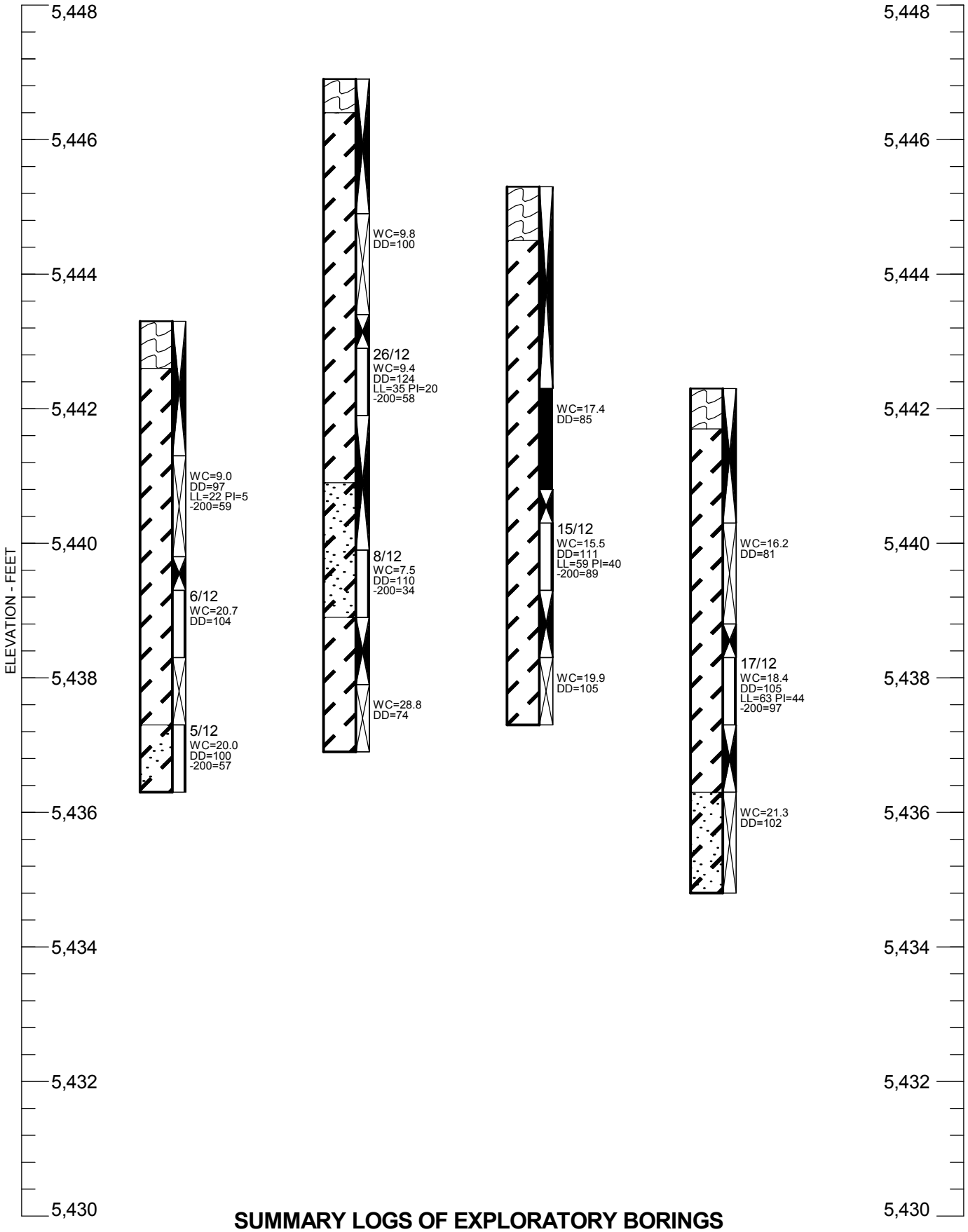
BORROW AREA #3



SUMMARY LOGS OF EXPLORATORY BORINGS

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FIG. A- 4

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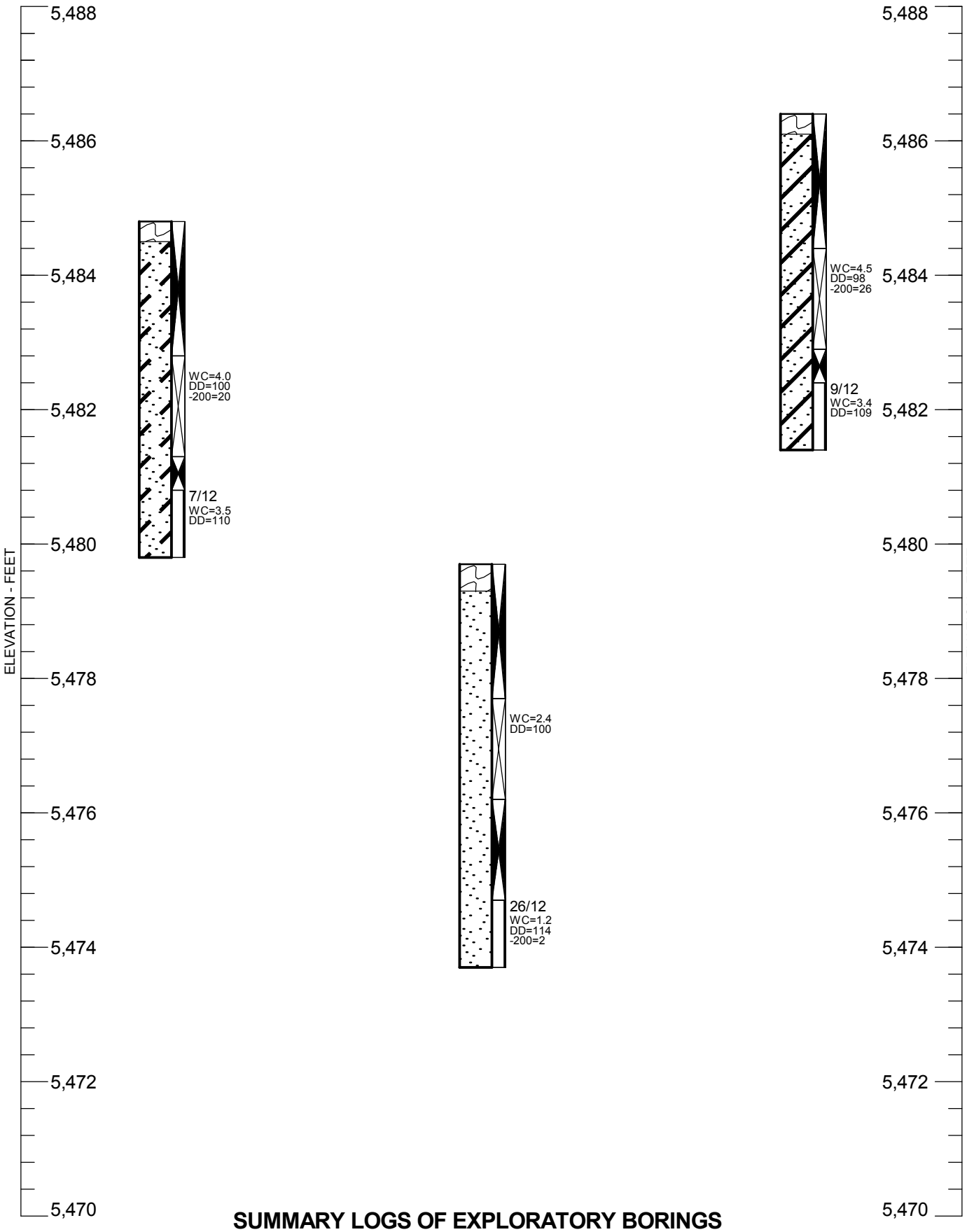
BORROW AREA #4



SUMMARY LOGS OF EXPLORATORY BORINGS

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FIG. A- 5

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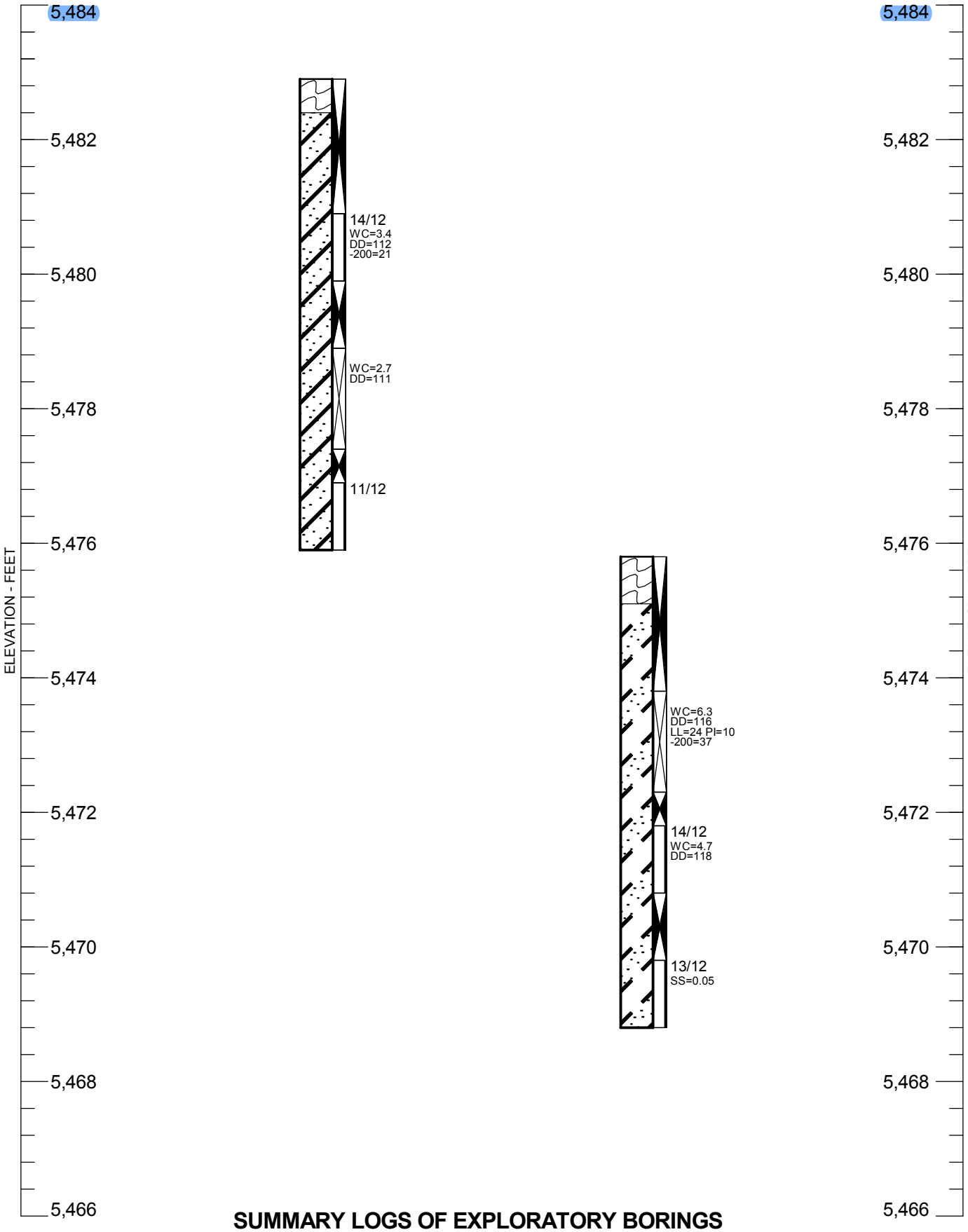
BORROW AREA #4



SUMMARY LOGS OF EXPLORATORY BORINGS

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FIG. A- 6

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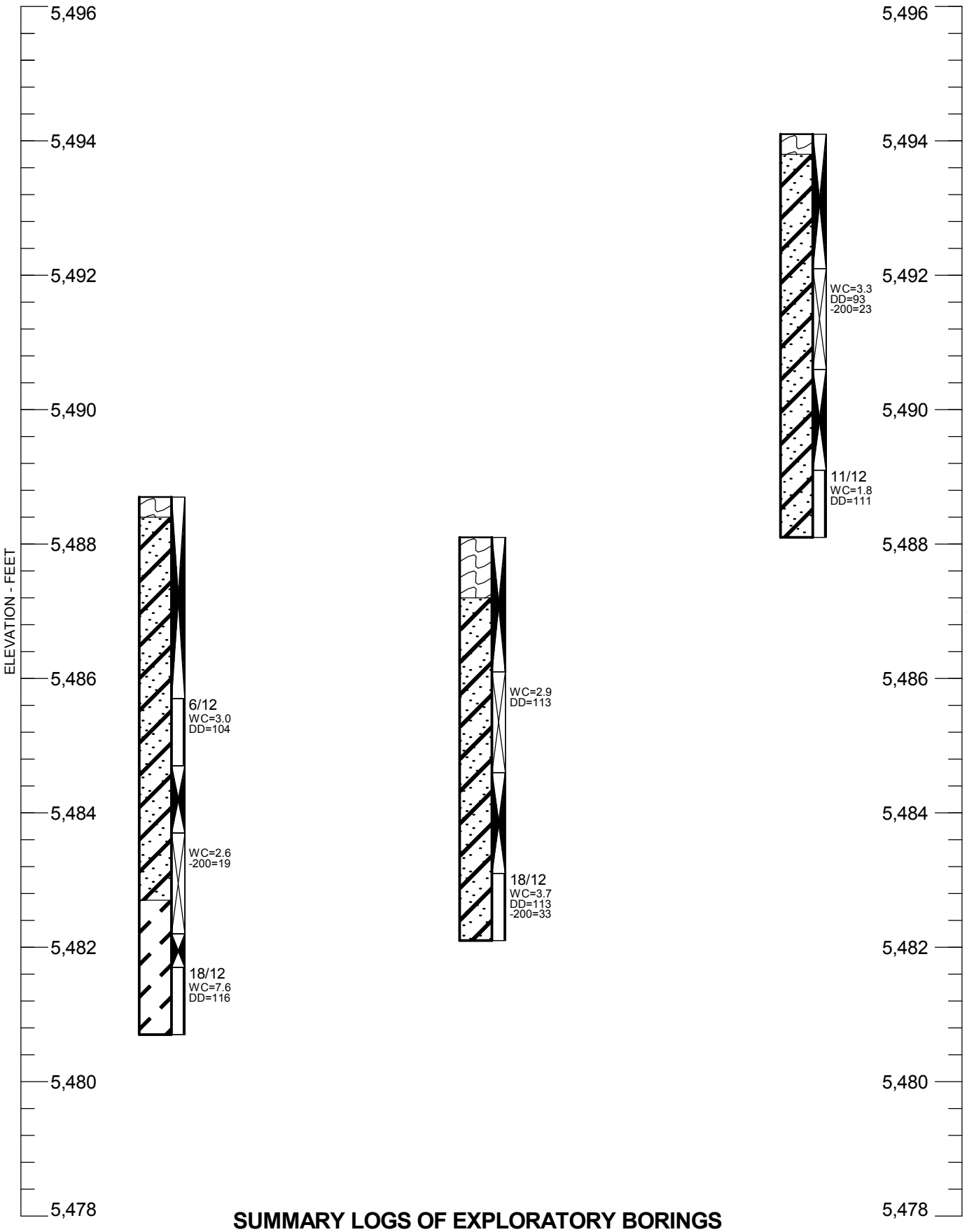
BORROW AREA #4



SUMMARY LOGS OF EXPLORATORY BORINGS

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FIG. A- 7

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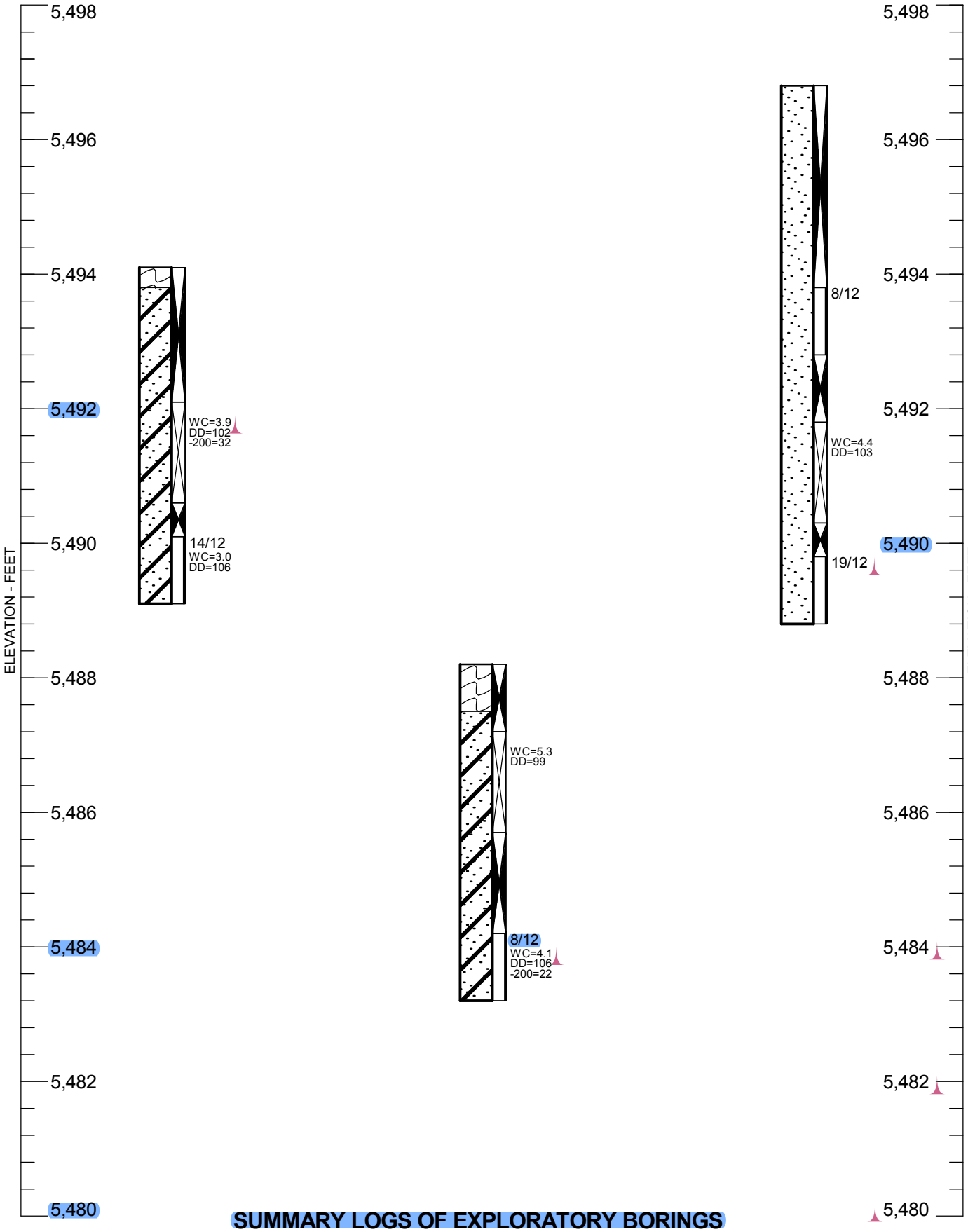
BORROW AREA #4



SUMMARY LOGS OF EXPLORATORY BORINGS

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FIG. A- 8

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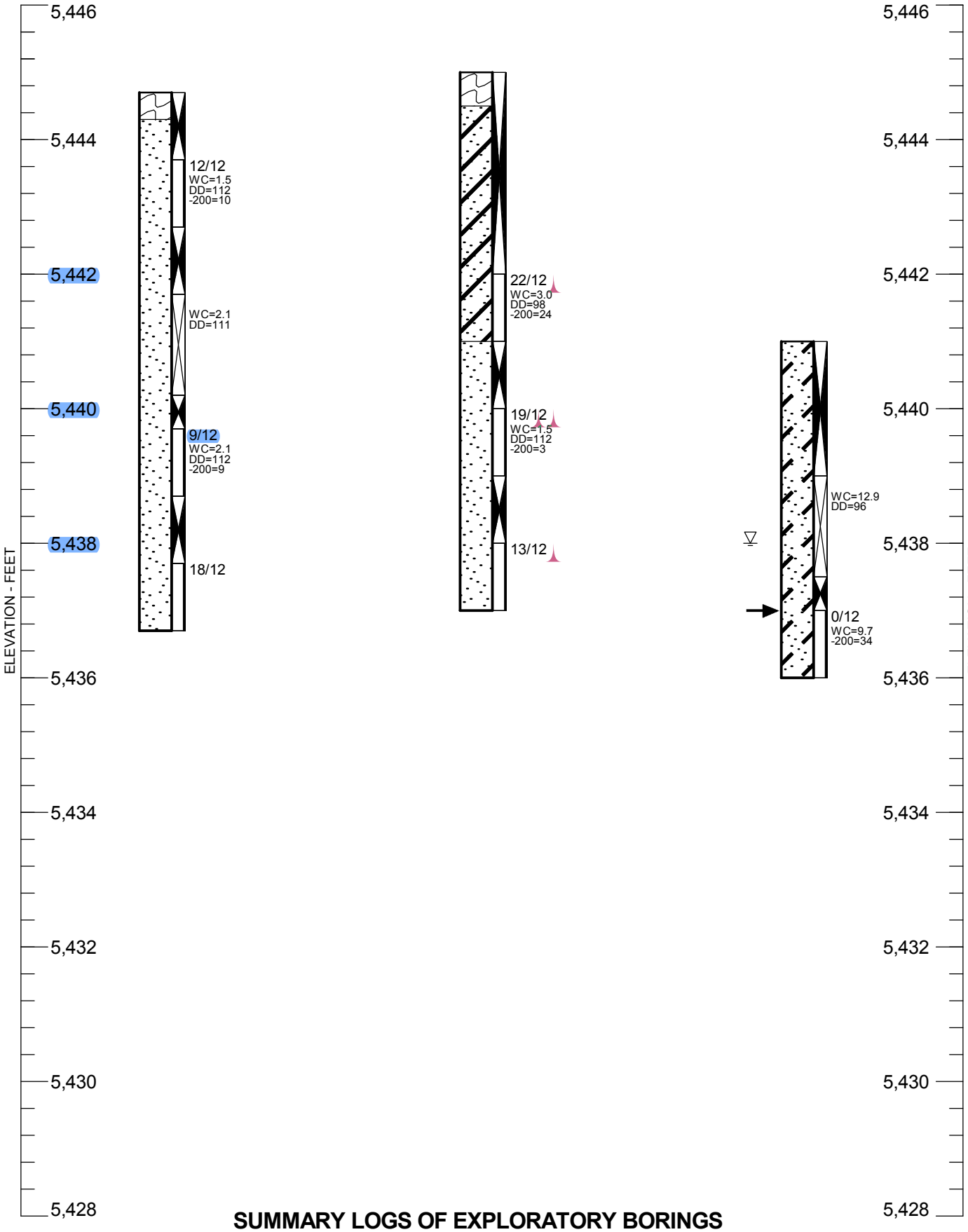
BORROW AREA #5



SUMMARY LOGS OF EXPLORATORY BORINGS

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FIG. A- 9

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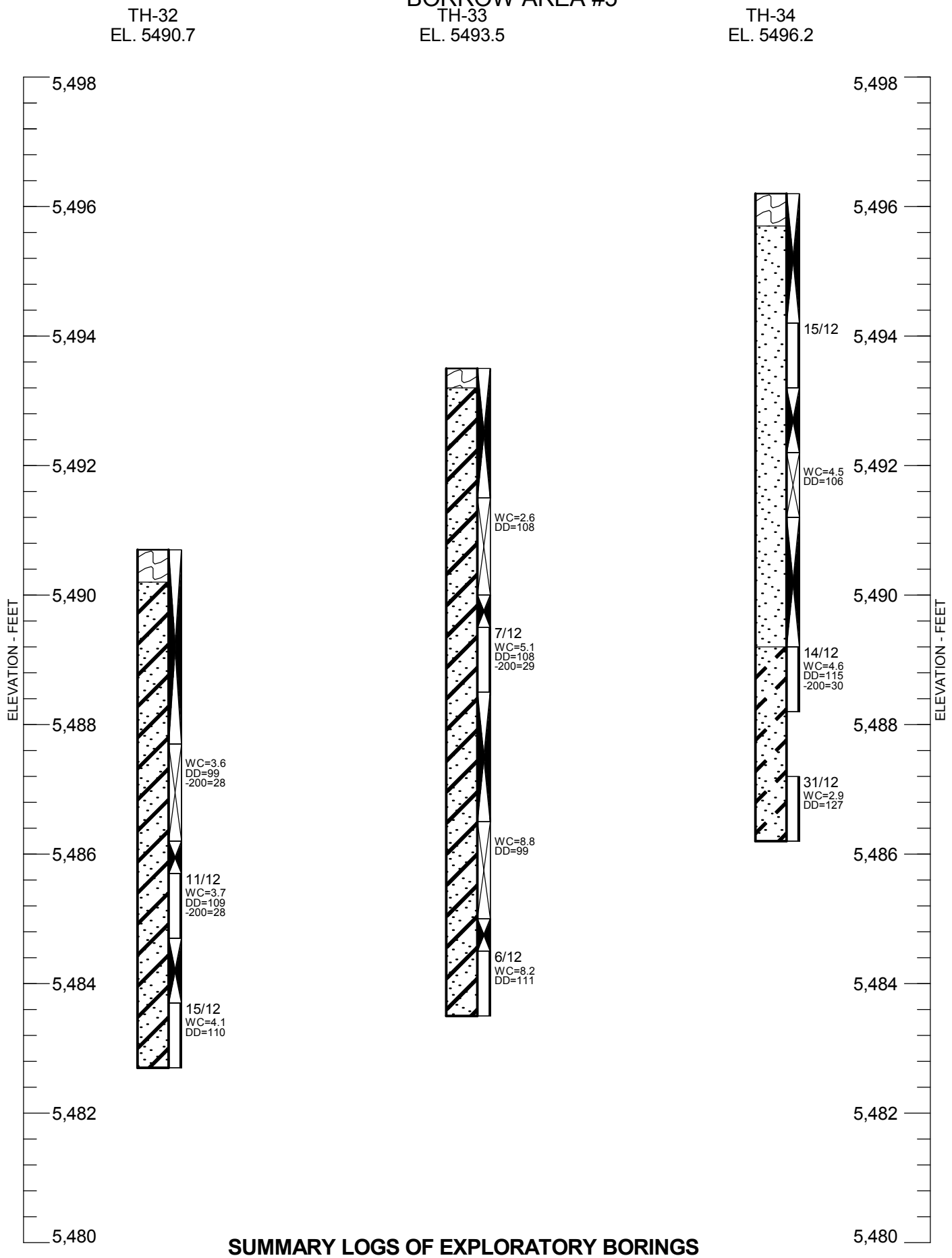
BORROW AREA #5



SUMMARY LOGS OF EXPLORATORY BORINGS

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PROJECT NO. DN44,189-115

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LEGEND:


TOPSOIL.


CLAY, SANDY, MEDIUM STIFF TO VERY STIFF, SLIGHTLY MOIST TO VERY MOIST, BROWN (CL).


SAND, CLAYEY, VERY LOOSE TO MEDIUM DENSE, SLIGHTLY MOIST TO WET, GRAY, BROWN (SC).


INTERLAYERED CLAY/SAND, LOOSE TO MEDIUM DENSE OR MEDIUM STIFF TO STIFF, SLIGHTLY MOIST, BROWN, GRAY (CL OR SC).


SAND, SILTY, LOOSE TO VERY DENSE, SLIGHTLY MOIST TO MOIST, BROWN (SM).


SAND, CLEAN TO SLIGHTLY SILTY, GRAVELLY, LOOSE TO VERY DENSE, SLIGHTLY MOIST, BROWN, GRAY (SP, SP-SM).


DRIVE SAMPLE. THE SYMBOL 50/10 INDICATES 50 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE A 2.5-INCH O.D. SAMPLER 10 INCHES.


BULK SAMPLE FROM AUGER CUTTINGS.


SHELBY TUBE (3"-O.D.) SAMPLES.


WATER LEVEL MEASURED AT TIME OF DRILLING.

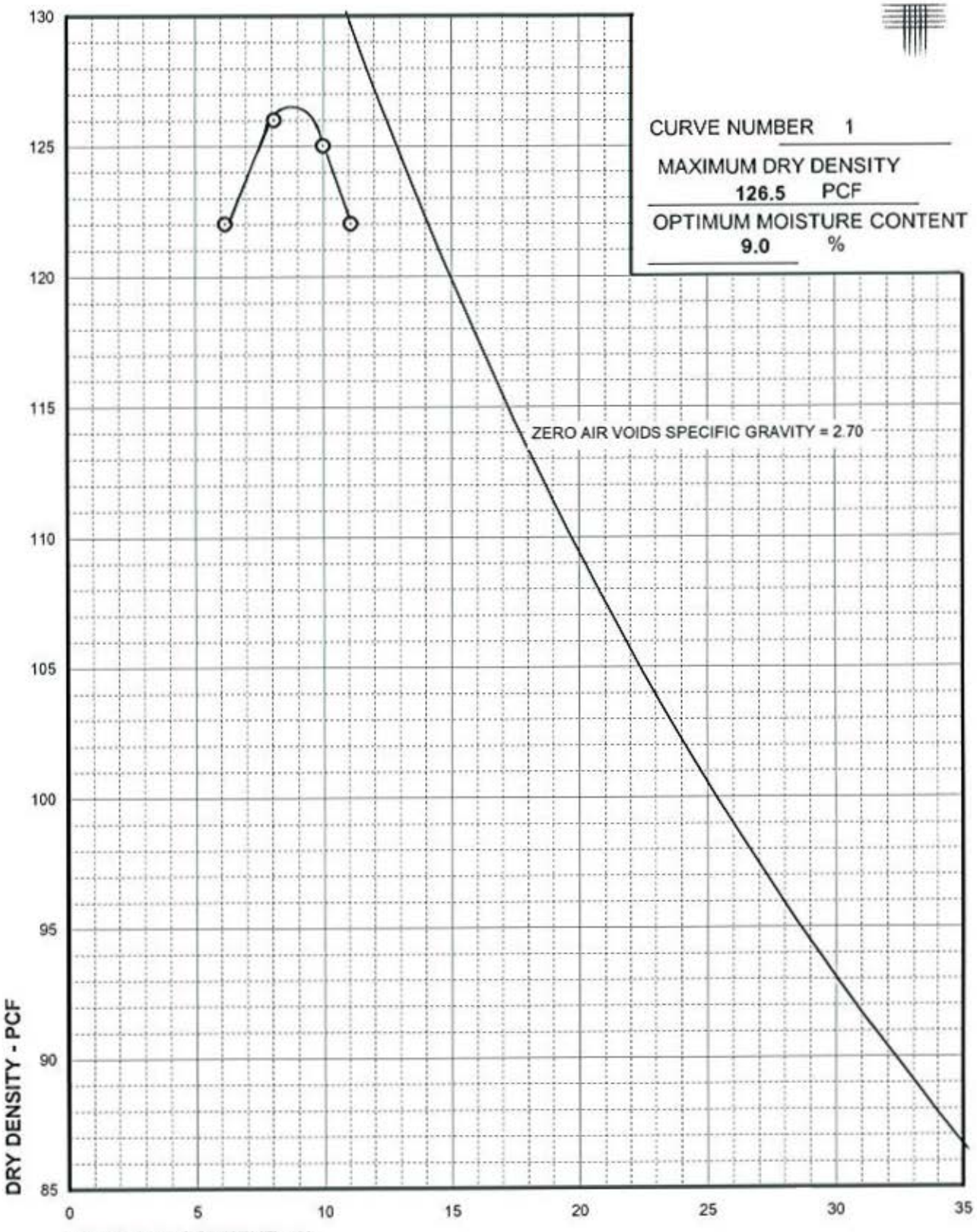

CAVING AFTER DRILLING.

NOTES:

1. THE BORINGS WERE DRILLED ON SEPTEMBER 29 AND 30, 2009 USING 4-INCH DIAMETER, CONTINUOUS-FLIGHT AUGER AND A TRUCK-MOUNTED DRILL RIG.
2. BORING LOCATIONS AND ELEVATIONS WERE STAKED AND SURVEYED BY AZTEC CONSULTANTS.
3. NO GROUND WATER WAS MEASURED WHEN THE HOLES WERE CHECKED ABOUT TWO WEEKS AFTER DRILLING (ON OCTOBER 16, 2009).
4. WC - INDICATES MOISTURE CONTENT (%).
   DD - INDICATES DRY DENSITY (PCF).
   LL - INDICATES LIQUID LIMIT (%).
   PI - INDICATES PLASTICITY INDEX (%).
   -200 - INDICATES PASSING NO. 200 SIEVE (%).
   SS - INDICATES WATER-SOLUBLE SULFATE CONTENT (%).
5. THESE LOGS ARE SUBJECT TO THE EXPLANATIONS, LIMITATIONS AND CONCLUSIONS CONTAINED IN THIS REPORT.

APPENDIX B

LABORATORY TEST RESULTS



Sample Description Sand, silty, clayey (SM-SC)

Location Combined sample from TH-2,8,20,25,30

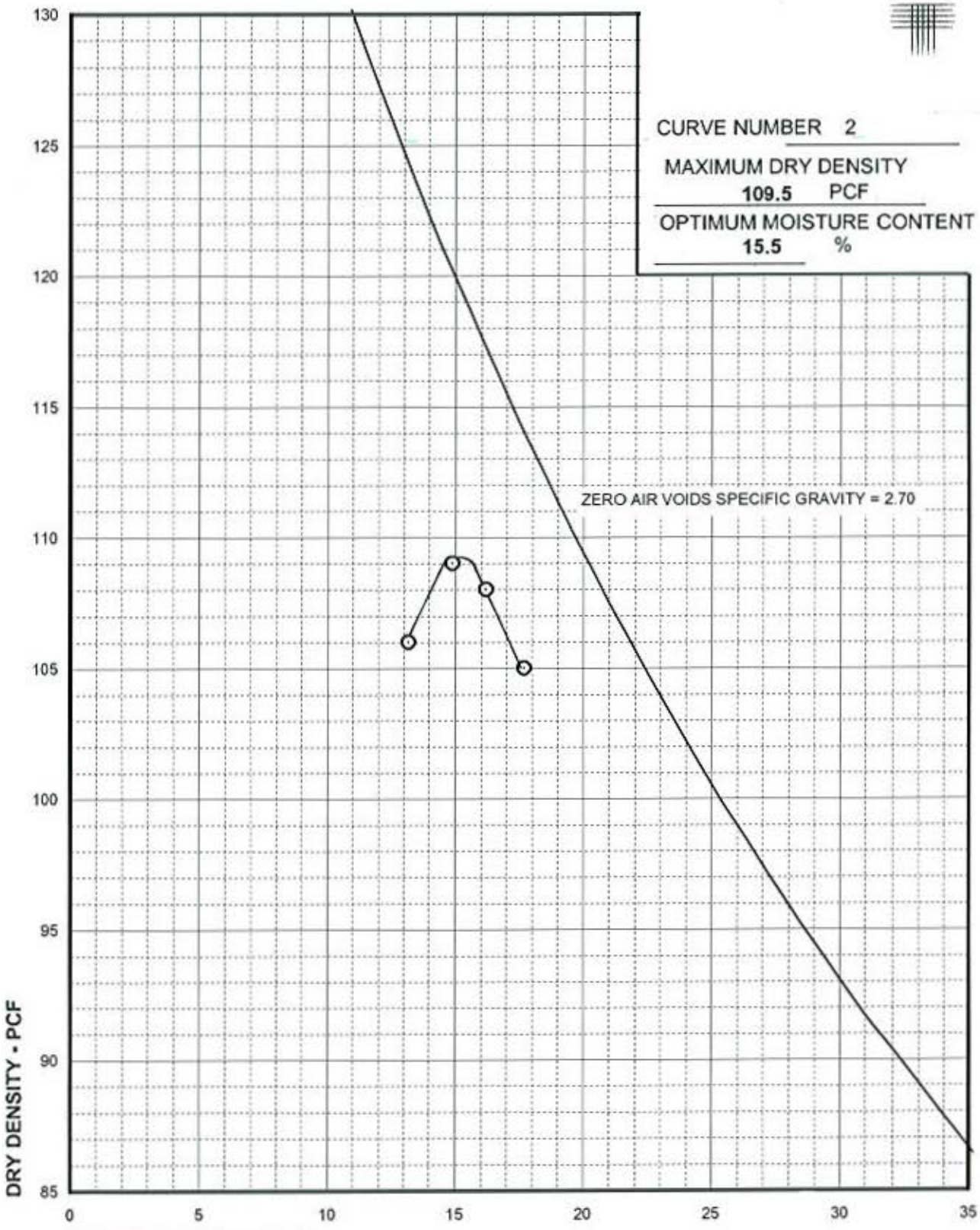
Compaction Test Procedure ASTM D 698
METHOD "A"

LIQUID LIMIT	22	%
PLASTICITY INDEX	7	%
GRAVEL	-	%
SAND	-	%
SILT AND CLAY	30	%

EDAW/AECOM
BORROW FILL SOIL INVESTIGATION
CHATFIELD RESERVOIR STORAGE REALLOCATION PROJECT
PROJECT NO. DN44,189-115
S:\PROJECTS\44100\DN44189.000\115\2 Reports\R1\DN44189-115-R1-X3(proctor1)

Compaction Test Results

Fig. B-1



Sample Description Clay, Sandy (CL)

Location Combined sample from TH-5,6,11,13,16

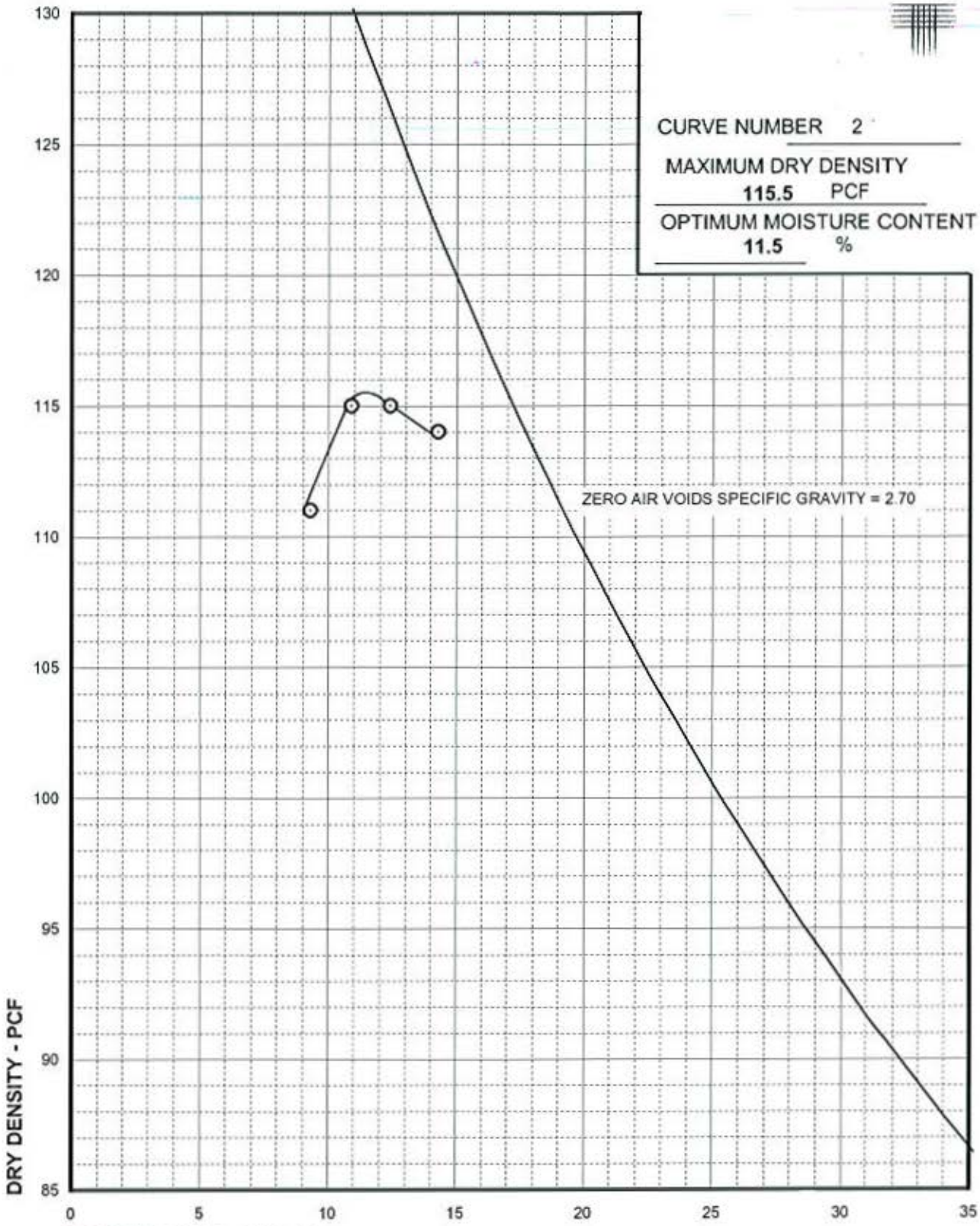
Compaction Test Procedure ASTM D 698
METHOD "A"

LIQUID LIMIT	38	%
PLASTICITY INDEX	19	%
GRAVEL	-	%
SAND	-	%
SILT AND CLAY	70	%

EDAW/AECOM
BORROW FILL SOIL INVESTIGATION
CHATFIELD RESERVOIR STORAGE REALLOCATION PROJECT
PROJECT NO. DN44,189-115
S:\PROJECTS\44100\DN44189.000\115\2. Reports\R1\DN44189-115-R1-X3(proctor 5,6,11)

Compaction Test Results

Fig. B-2



Sample Description Clay/Sand (CL or SC)

Location Combined sample from TH-10,14,15,17,22,23

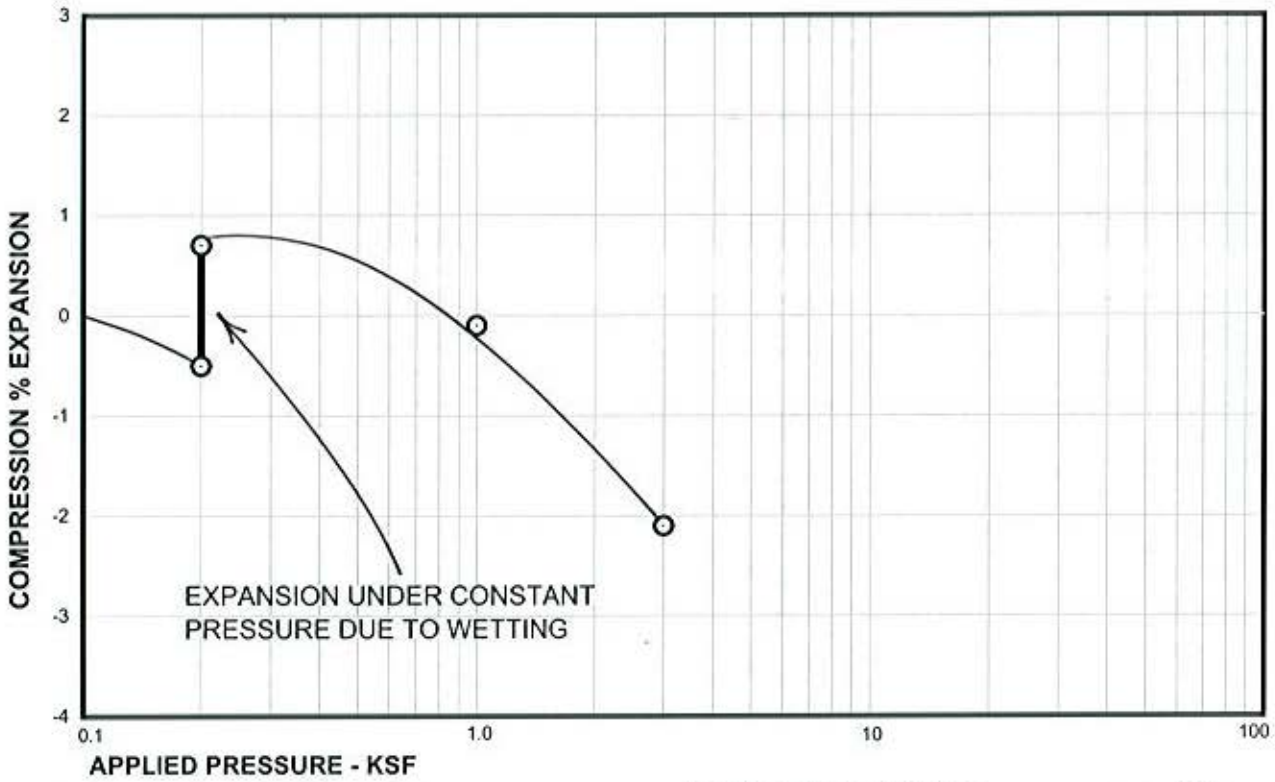
Compaction Test Procedure ASTM D 698
METHOD "A"

LIQUID LIMIT	27	%
PLASTICITY INDEX	12	%
GRAVEL	-	%
SAND	-	%
SILT AND CLAY	50	%

EDAW/AECOM
BORROW FILL SOIL INVESTIGATION
CHATFIELD RESERVOIR STORAGE REALLOCATION PROJECT
PROJECT NO. DN44,189-115
S:\PROJECTS\44100\DN44189.000\115\2. Reports\R1\DN44189-115-R1-X3(proctor3)

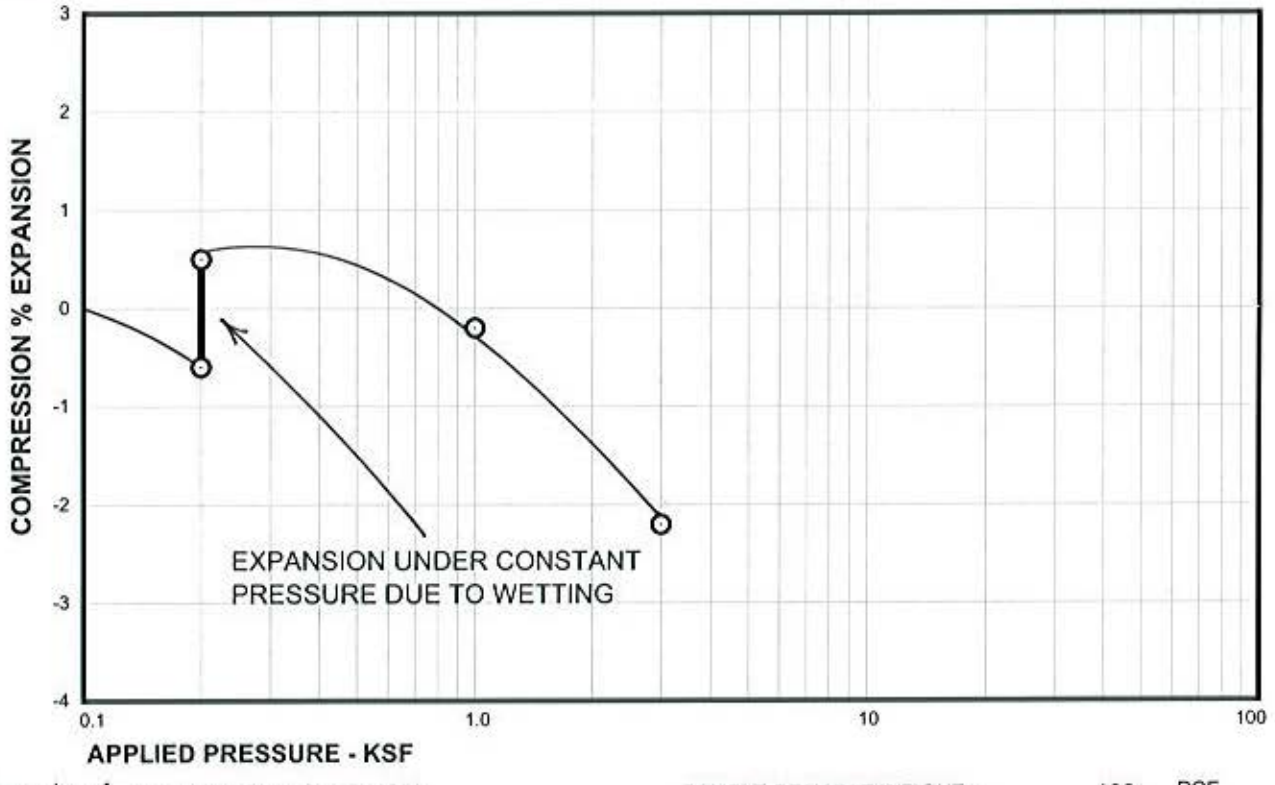
Compaction Test Results

Fig. B-3



Sample of Remolded Clay, Sandy (CL)
From Combined sample from TH-5,6,11,13,16

SAMPLE DRY UNIT WEIGHT= 103 PCF
SAMPLE MOISTURE CONTENT= 16.2 %



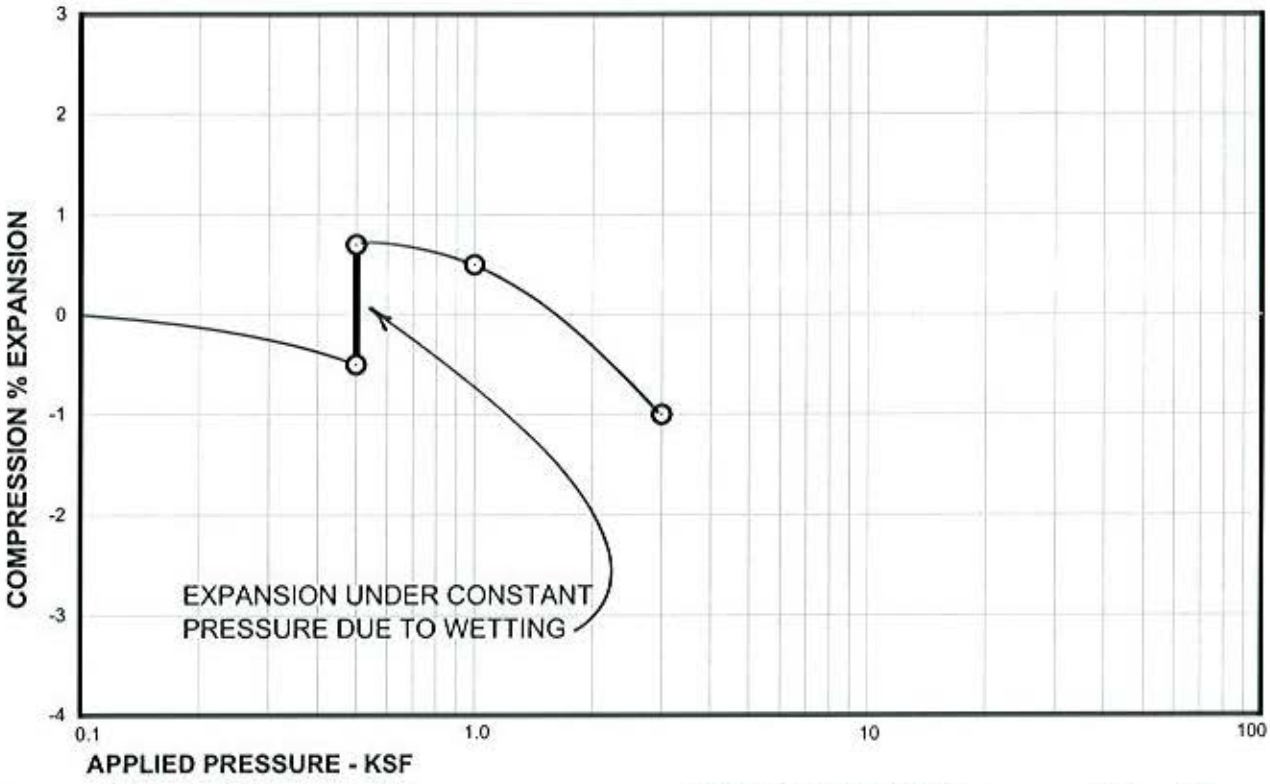
Sample of Remolded Clay, Sandy (CL)
From Combined sample from TH-5,6,11,13,16

SAMPLE DRY UNIT WEIGHT= 103 PCF
SAMPLE MOISTURE CONTENT= 18.0 %

EDAW/AECOM
BORROW FILL SOIL INVESTIGATION
CHATFIELD RESERVOIR STORAGE REALLOCATION PROJECT
PROJECT NO. DN44,189-115
S:\PROJECTS\44100\DN44189.000\115\2. Reports\R1\DN44189-115-R1-X4(SWELL)

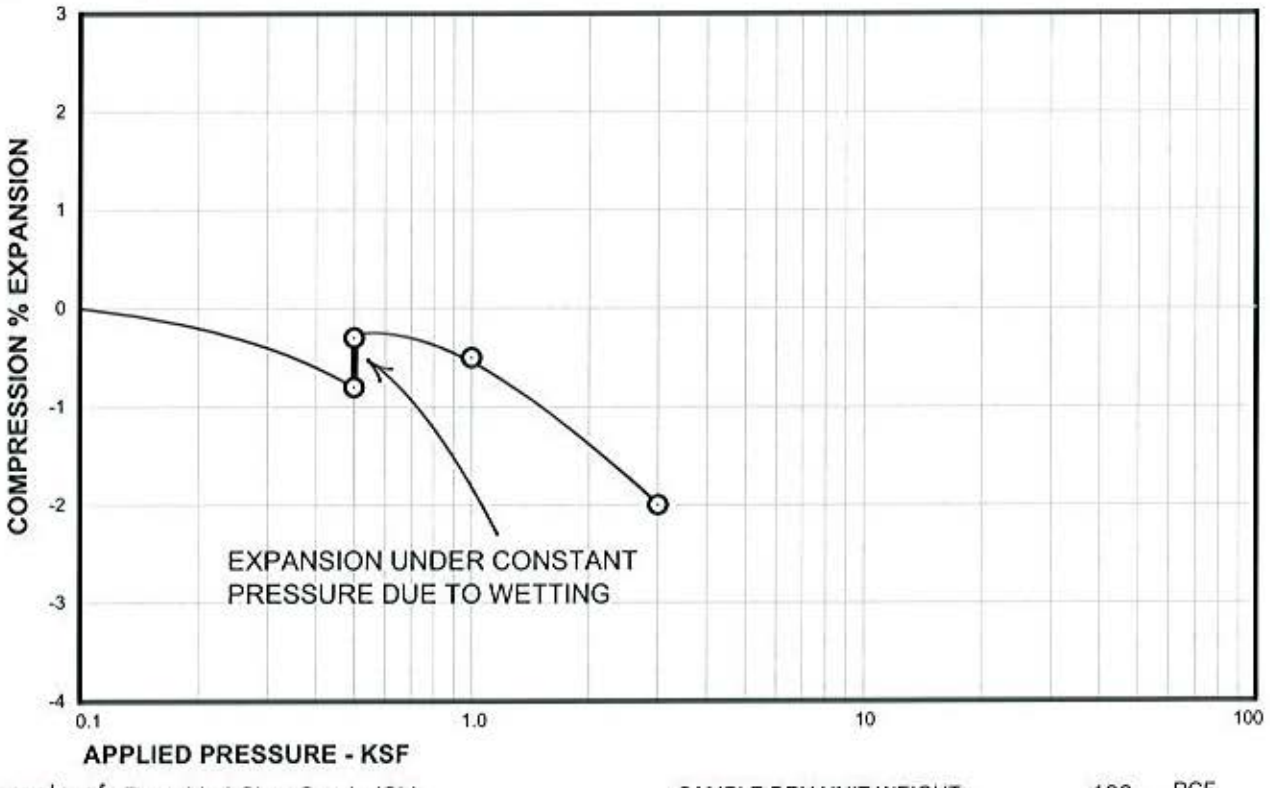
Swell Consolidation Test Results

FIG. B-4



Sample of Remolded Clay, Sandy (CL)
From Combined sample from TH-5,6,11,13,16

SAMPLE DRY UNIT WEIGHT= 103 PCF
SAMPLE MOISTURE CONTENT= 16.4 %



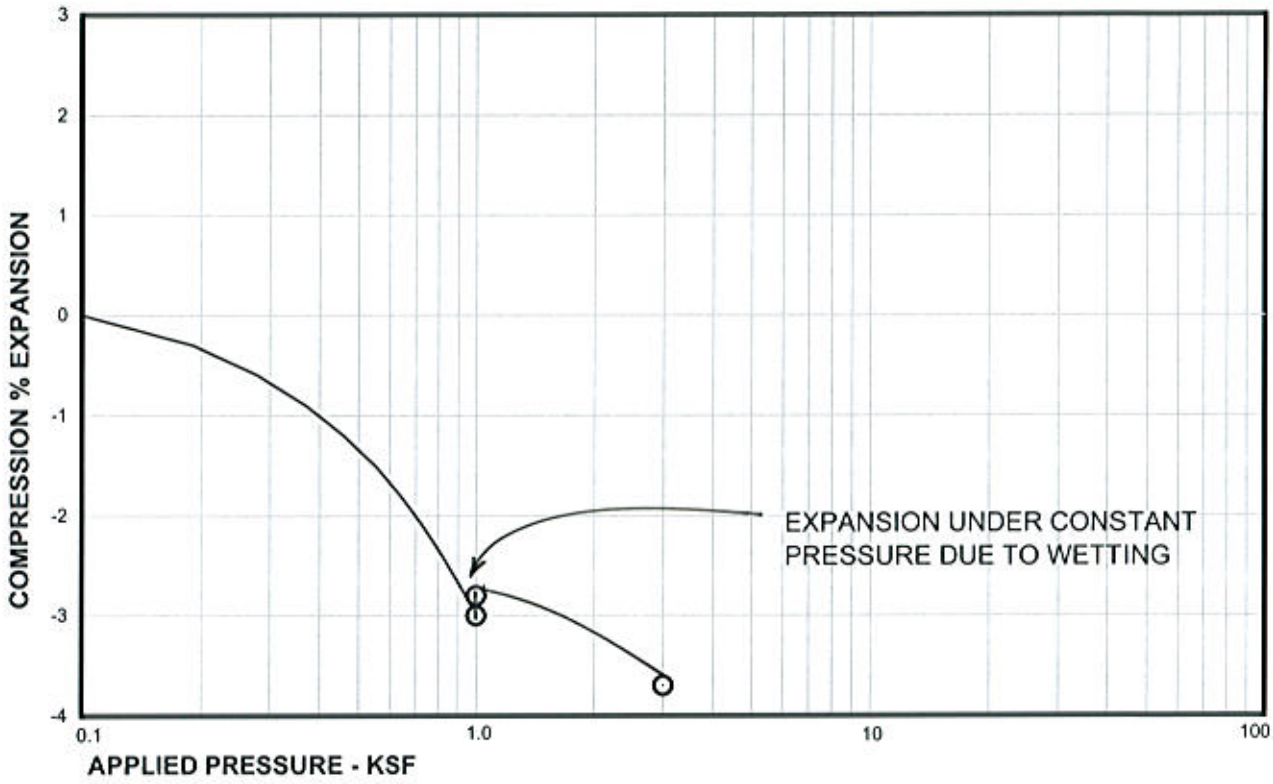
Sample of Remolded Clay, Sandy (CL)
From Combined sample from TH-5,6,11,13,16

SAMPLE DRY UNIT WEIGHT= 103 PCF
SAMPLE MOISTURE CONTENT= 18.1 %

EDAW/AECOM
BORROW FILL SOIL INVESTIGATION
CHATFIELD RESERVOIR STORAGE REALLOCATION PROJECT
PROJECT NO. DN44,189-115
S:\PROJECTS\44100\DN44189.000\115\2. Reports\R1\DN44189-115-R1-X4(SWELL)

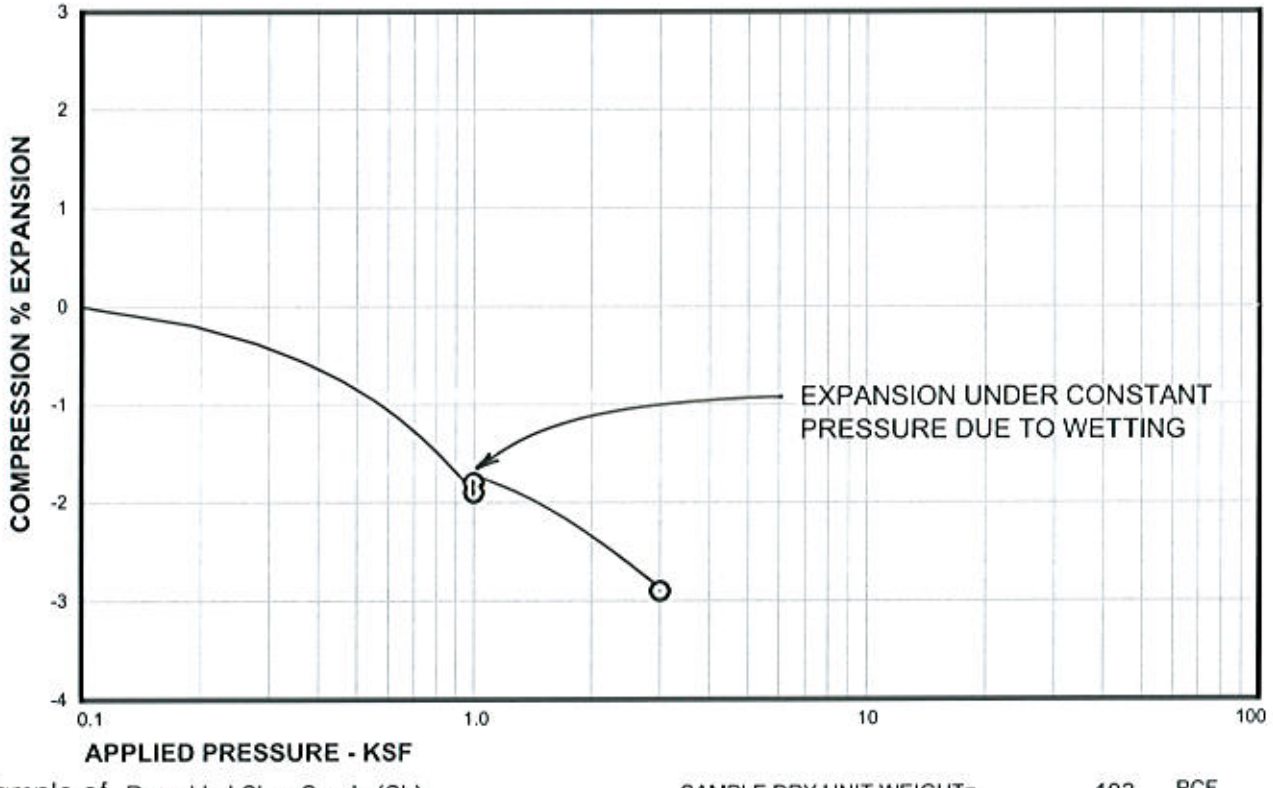
Swell Consolidation Test Results

FIG. B-5



Sample of Remolded Clay, Sandy (CL)
From Combined sample from TH-5,6,11,13,16

SAMPLE DRY UNIT WEIGHT= 103 PCF
SAMPLE MOISTURE CONTENT= 16.7 %



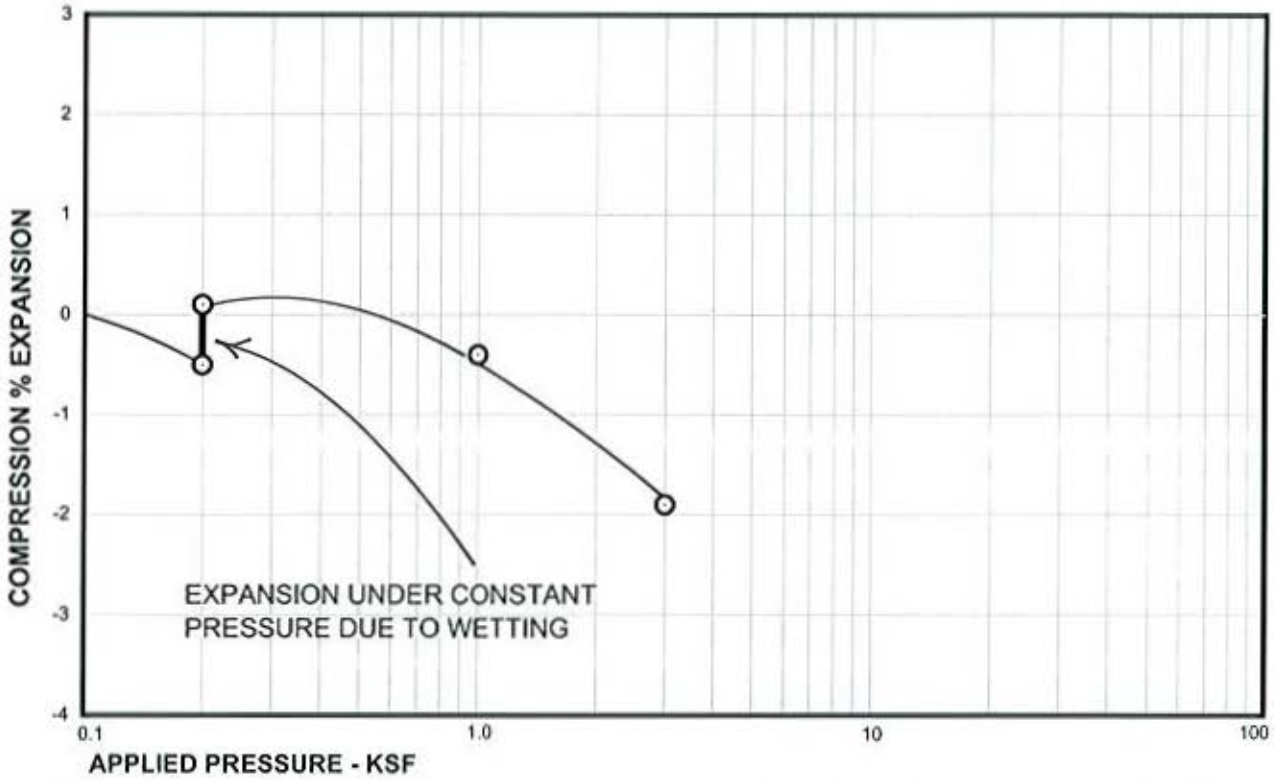
Sample of Remolded Clay, Sandy (CL)
From Combined sample from TH-5,6,11,13,16

SAMPLE DRY UNIT WEIGHT= 103 PCF
SAMPLE MOISTURE CONTENT= 17.9 %

EDAW/AECOM
BORROW FILL SOIL INVESTIGATION
CHATFIELD RESERVOIR STORAGE REALLOCATION PROJECT
PROJECT NO. DN44,189-115
S:\PROJECTS\44100\DN44189.000\115\2. Reports\R1\DN44189-115-R1-X4(SWELL)

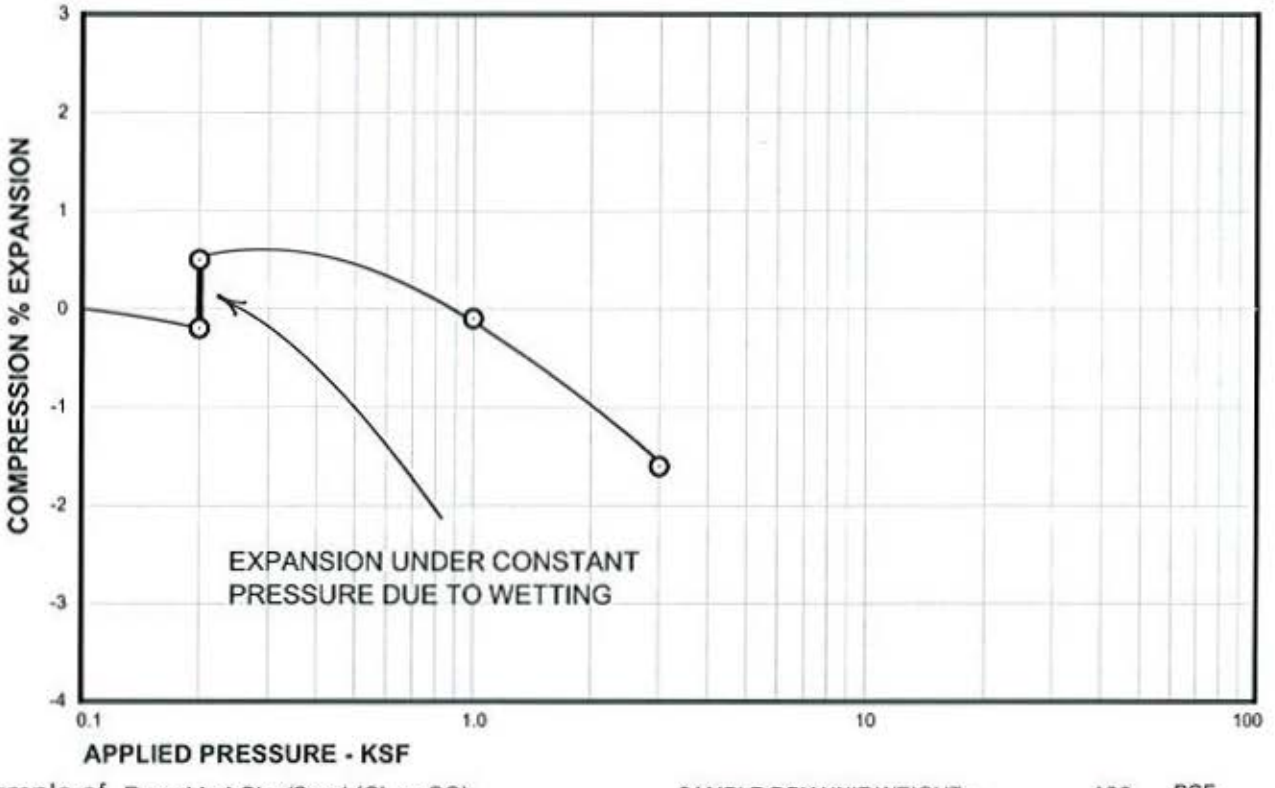
Swell Consolidation Test Results

FIG. B-6



Sample of Remolded Clay/Sand (CL or SC) SAMPLE DRY UNIT WEIGHT= 109 PCF

From Combined sample from TH-10,14,15,17,22,23 SAMPLE MOISTURE CONTENT= 13.7 %



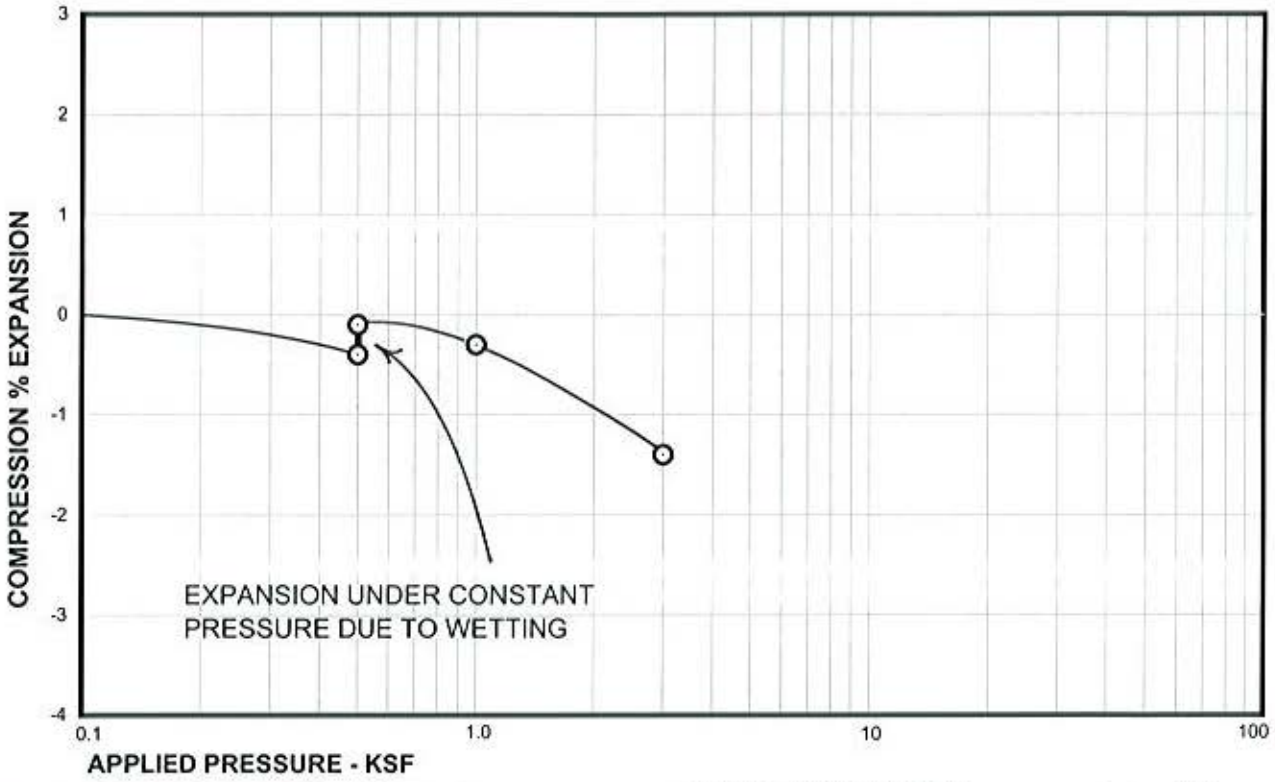
Sample of Remolded Clay/Sand (CL or SC) SAMPLE DRY UNIT WEIGHT= 109 PCF

From Combined sample from TH-10,14,15,17,22,23 SAMPLE MOISTURE CONTENT= 11.9 %

EDAW/AECOM
BORROW FILL SOIL INVESTIGATION
CHATFIELD RESERVOIR STORAGE REALLOCATION PROJECT
PROJECT NO. DN44,189-115
S:\PROJECTS\44100\DN44189.000\115\2. Reports\R1\DN44189-115-R1-X4(SWELL)

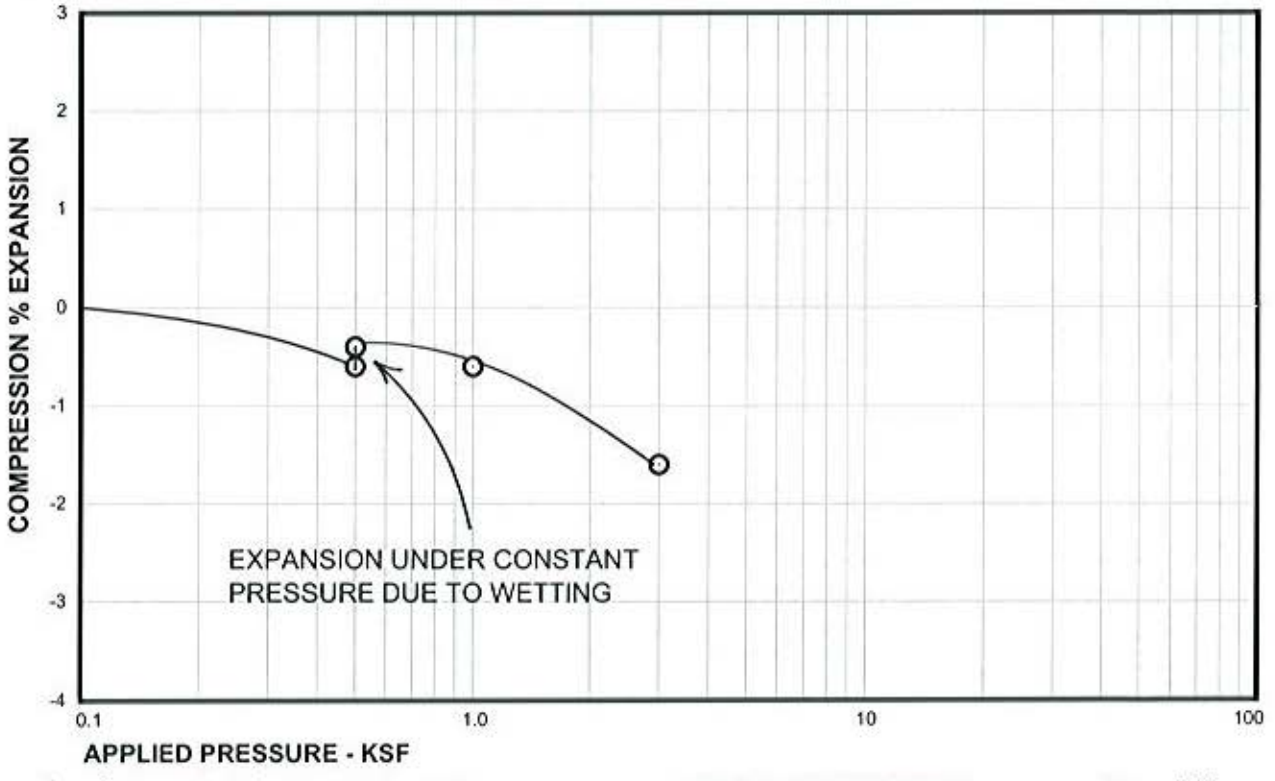
Swell Consolidation Test Results

FIG. B-7



Sample of Remolded Clay/Sand (CL or SC) SAMPLE DRY UNIT WEIGHT= 109 PCF

From Combined sample from TH-10,14,15,17,22,23 SAMPLE MOISTURE CONTENT= 11.9 %



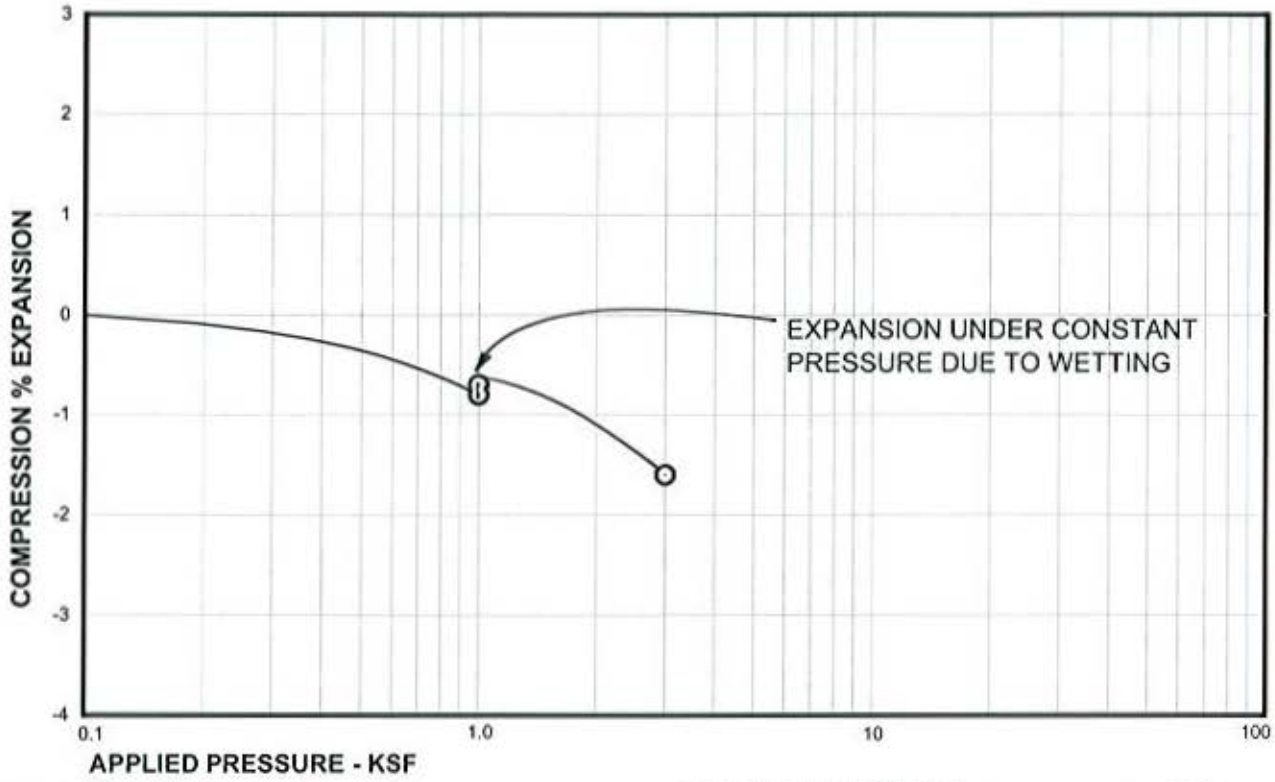
Sample of Remolded Clay/Sand (CL or SC) SAMPLE DRY UNIT WEIGHT= 109 PCF

From Combined sample from TH-10,14,15,17,22,23 SAMPLE MOISTURE CONTENT= 13.7 %

EDAW/AECOM
BORROW FILL SOIL INVESTIGATION
CHATFIELD RESERVOIR STORAGE REALLOCATION PROJECT
PROJECT NO. DN44,189-115
S:\PROJECTS\44100\DN44189.000\115\2. Reports\R1\DN44189-115-R1-X4(SWELL)

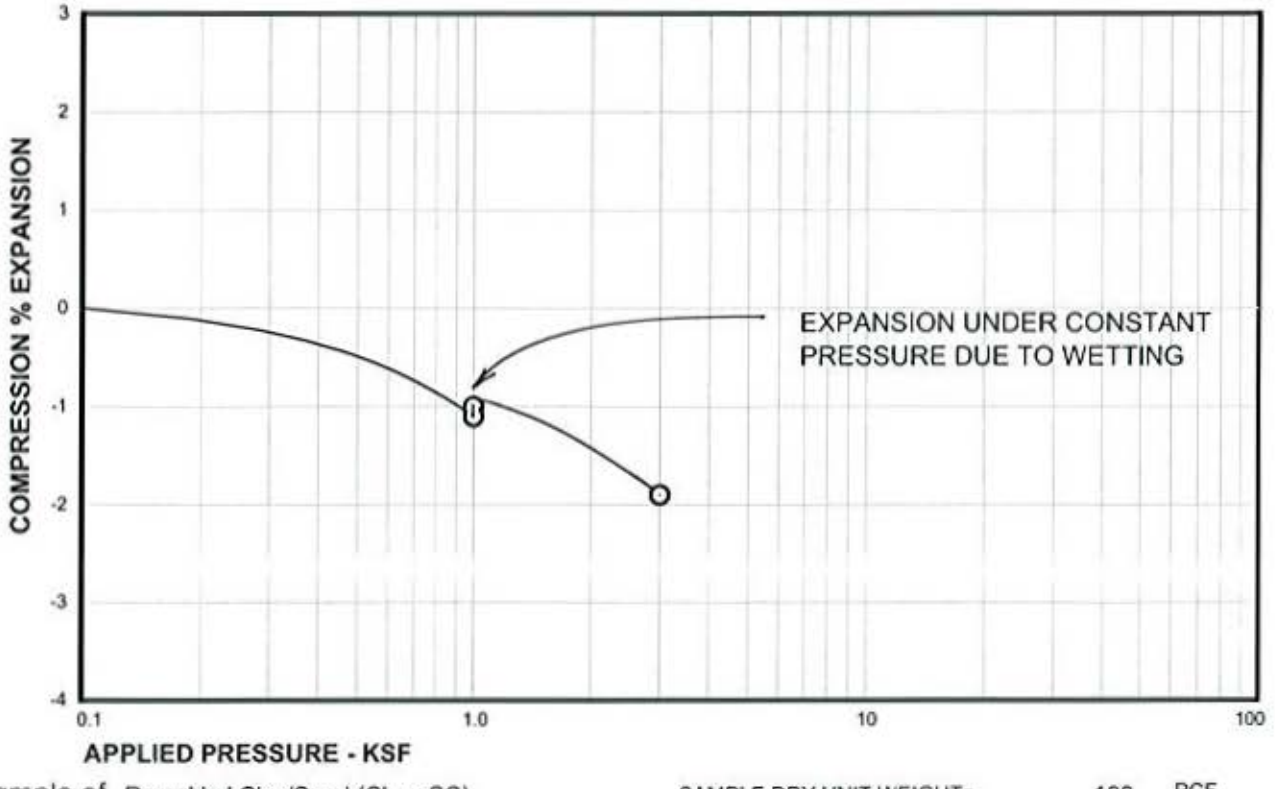
Swell Consolidation Test Results

FIG. B-8



Sample of Remolded Clay/Sand (CL or SC) SAMPLE DRY UNIT WEIGHT= 108 PCF

From Combined sample from TH-10,14,15,17,22,23 SAMPLE MOISTURE CONTENT= 11.9 %



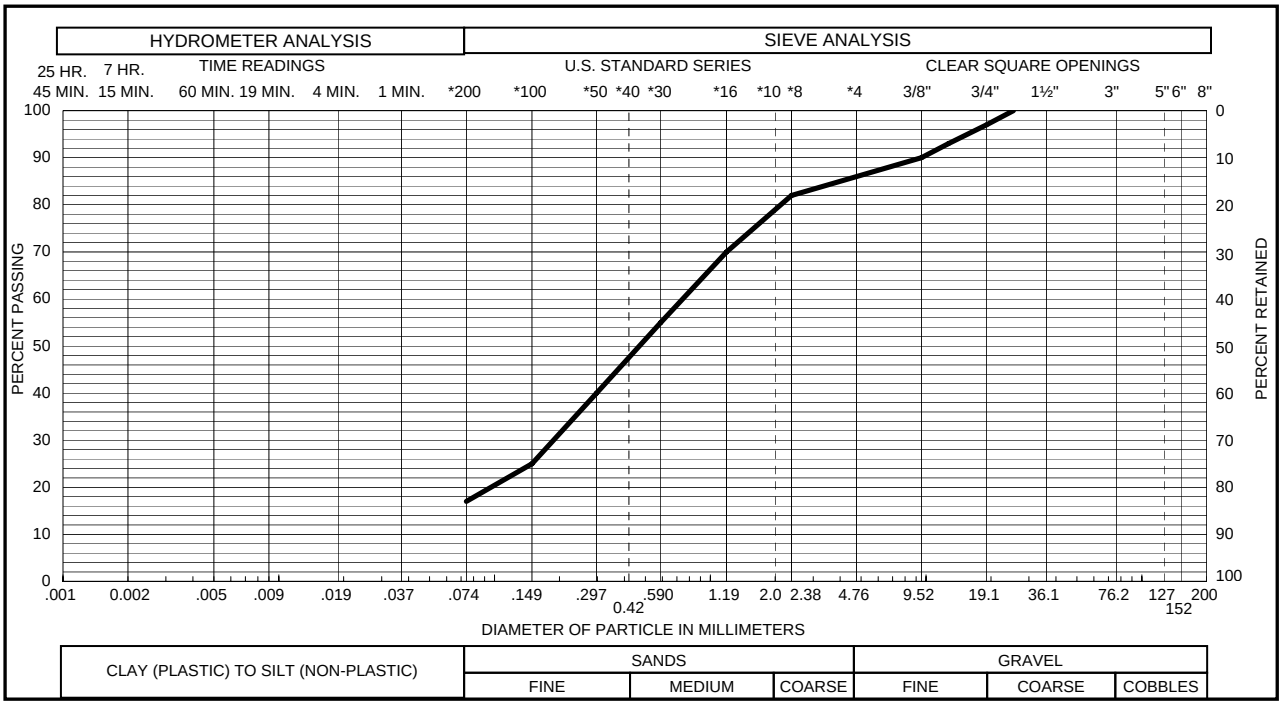
Sample of Remolded Clay/Sand (CL or SC) SAMPLE DRY UNIT WEIGHT= 109 PCF

From Combined sample from TH-10,14,15,17,22,23 SAMPLE MOISTURE CONTENT= 13.7 %

EDAW/AECOM
BORROW FILL SOIL INVESTIGATION
CHATFIELD RESERVOIR STORAGE REALLOCATION PROJECT
PROJECT NO. DN44,189-115
S:\PROJECTS\44100\DN44189.000\115\2. Reports\R1\DN44189-115-R1-X4(SWELL)

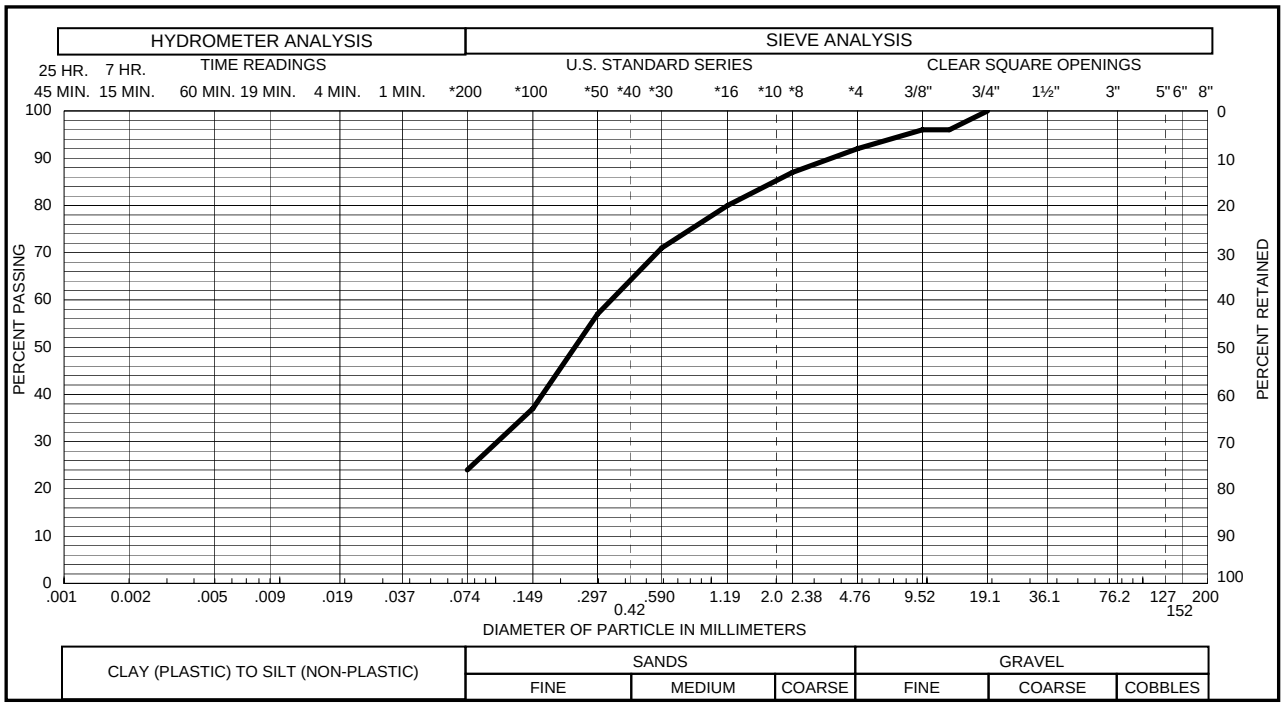
Swell Consolidation Test Results

FIG. B-9



Sample of SAND, SILTY (SM)
From TH - 1 AT 7 FEET

GRAVEL 14 % SAND 69 %
SILT & CLAY 17 % LIQUID LIMIT - %
PLASTICITY INDEX - %

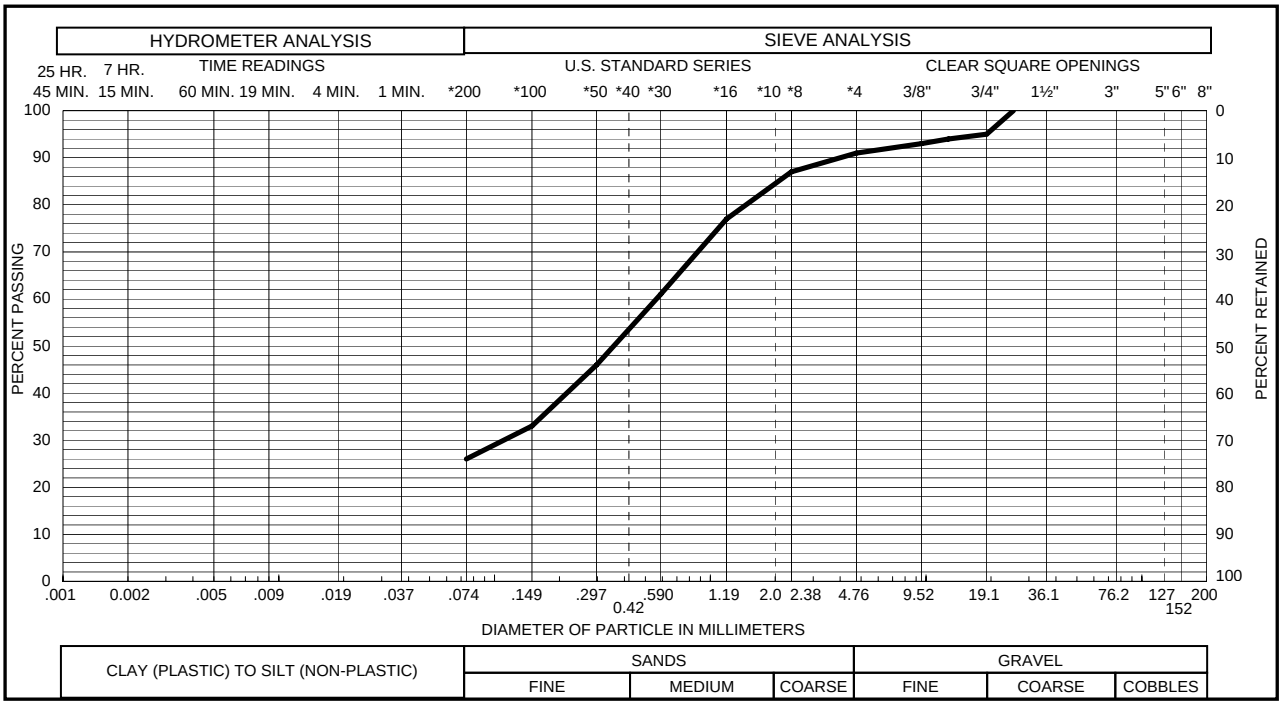


Sample of SAND, SILTY (SM)
From TH - 3 AT 4 FEET

GRAVEL 8 % SAND 68 %
SILT & CLAY 24 % LIQUID LIMIT - %
PLASTICITY INDEX - %

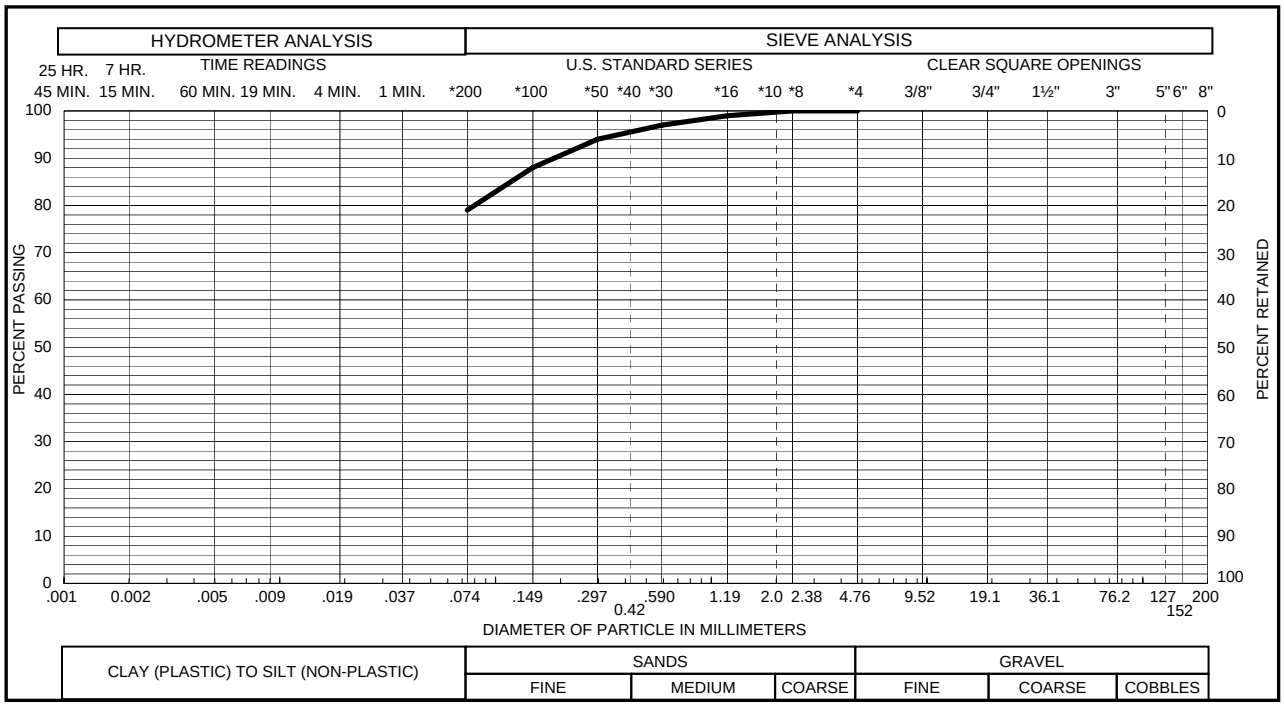
Gradation Test Results

FIG. B-10



Sample of SAND, SILTY (SM)
From TH - 7 AT 2 FEET

GRAVEL 9 % SAND 65 %
SILT & CLAY 26 % LIQUID LIMIT - %
PLASTICITY INDEX - %



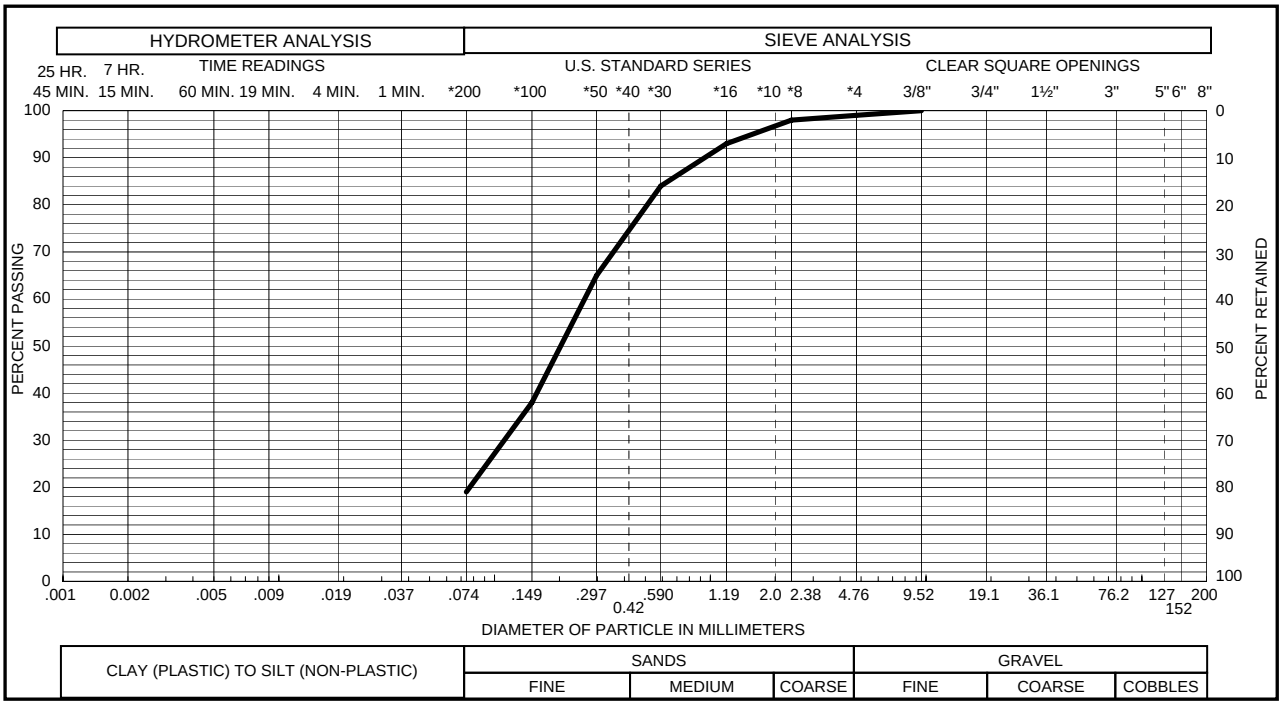
Sample of CLAY, SANDY (CL)
From TH - 8 AT 1 FEET

GRAVEL 0 % SAND 21 %
SILT & CLAY 79 % LIQUID LIMIT - %
PLASTICITY INDEX - %

Gradation Test Results

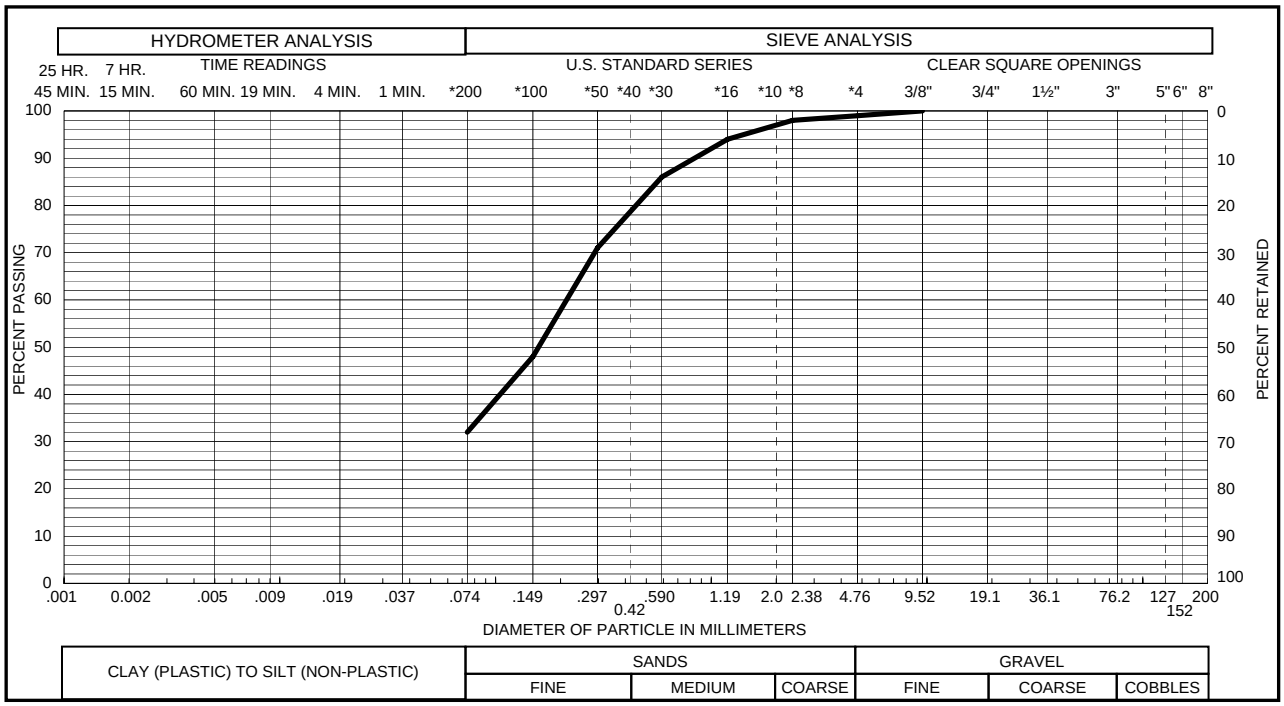
FIG. B-11

EDAW/AECOM
BORROW FILL SOIL INVESTIGATION
CHATFIELD RESERVOIR STORAGE REALLOCATION PROJECT
PROJECT NO. DN44,189-115
S:\PROJECTS\44100\DN44189.000\115\2. Reports\R1\dn44189-115-r1-x1(grad)



Sample of SAND, SILTY (SM)
From TH - 23 AT 5 FEET

GRAVEL 1 % SAND 80 %
SILT & CLAY 19 % LIQUID LIMIT - %
PLASTICITY INDEX - %



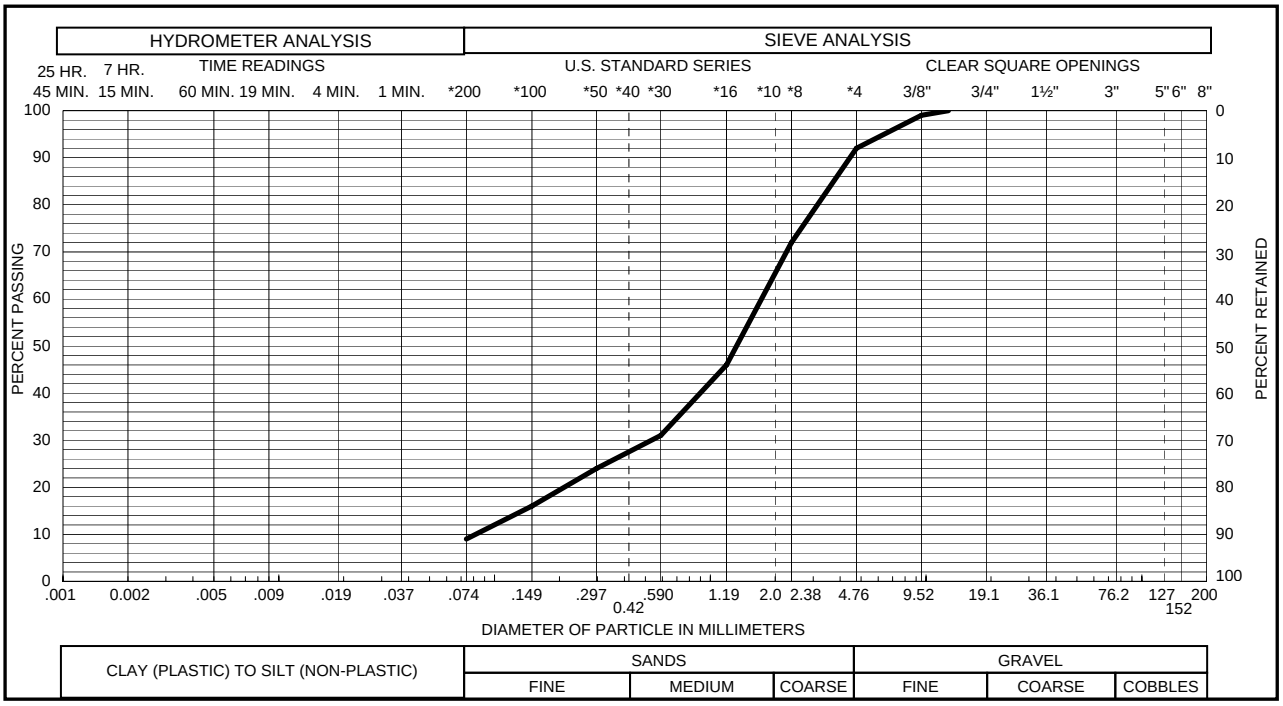
Sample of SAND, SILTY (SM)
From TH - 26 AT 2 FEET

GRAVEL 1 % SAND 67 %
SILT & CLAY 32 % LIQUID LIMIT - %
PLASTICITY INDEX - %

Gradation Test Results

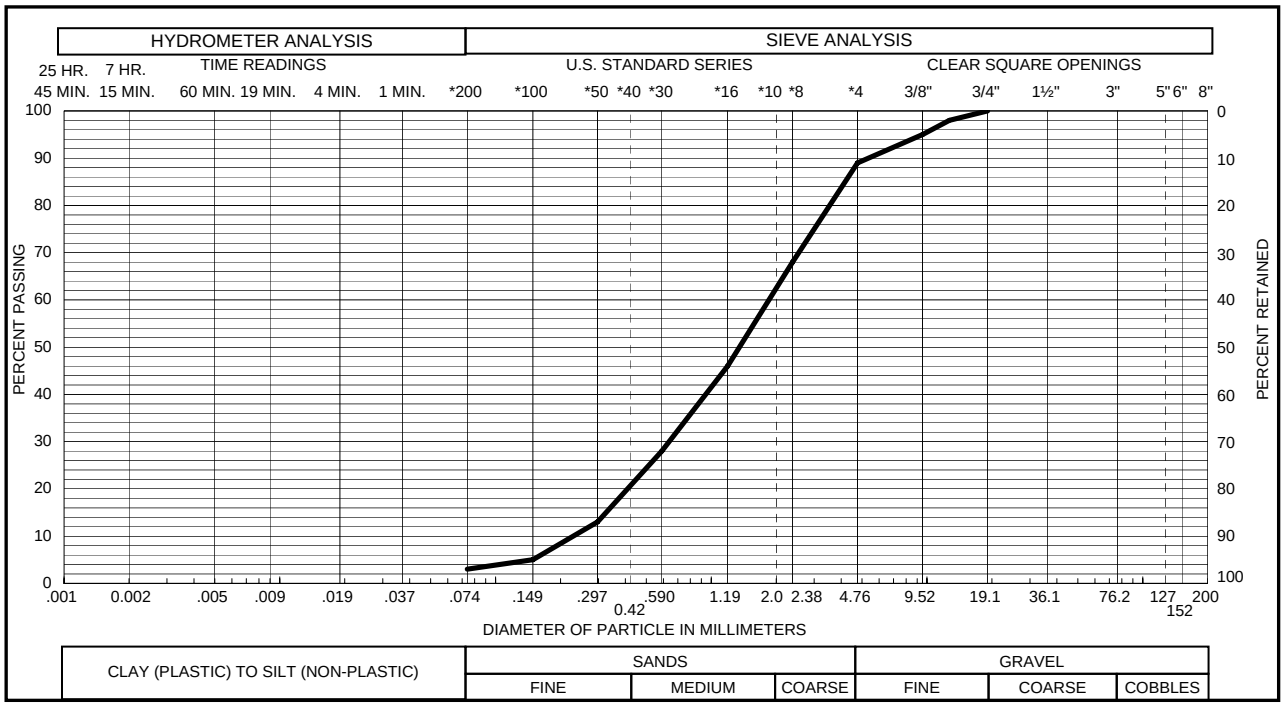
FIG. B-12

EDAW/AECOM
BORROW FILL SOIL INVESTIGATION
CHATFIELD RESERVOIR STORAGE REALLOCATION PROJECT
PROJECT NO. DN44,189-115
S:\PROJECTS\44100\DN44189.000\115\2. Reports\R1\dn44189-115-r1-x1(grad)



Sample of SAND, SLIGHTLY SILTY (SP-SM)
From TH - 29 AT 5 FEET

GRAVEL 8 % SAND 83 %
SILT & CLAY 9 % LIQUID LIMIT - %
PLASTICITY INDEX - %



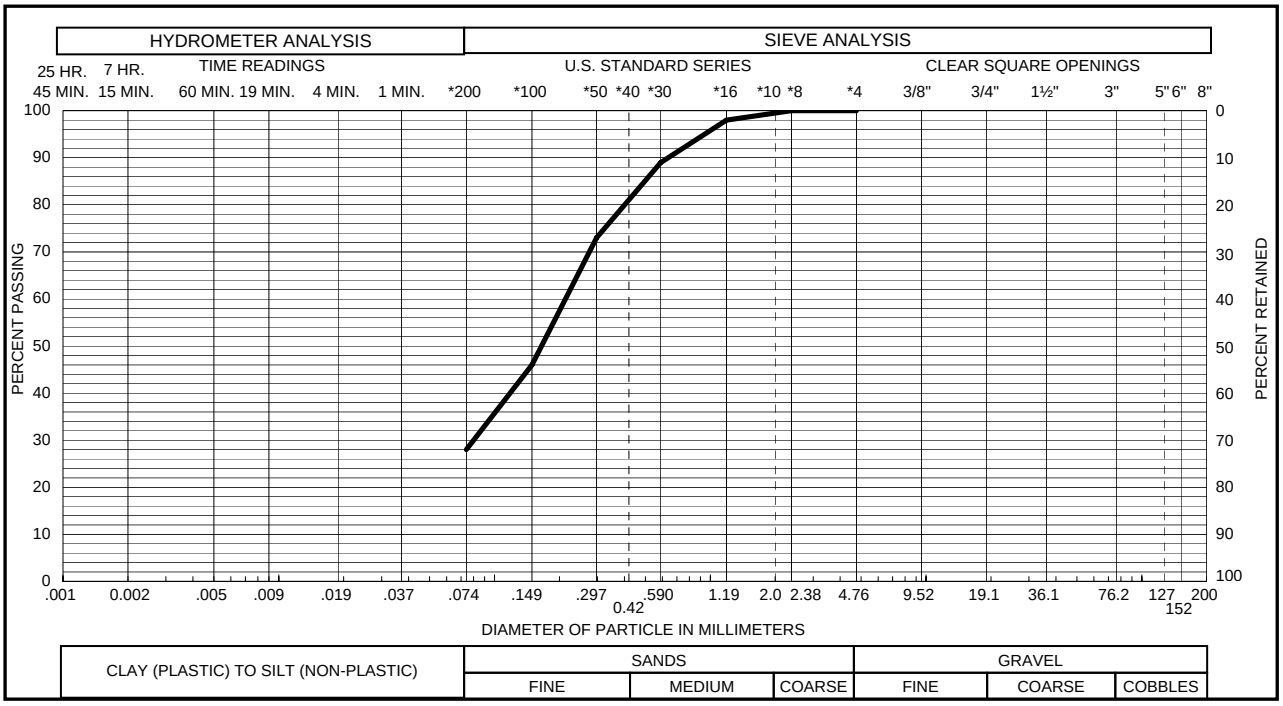
Sample of SAND, CLEAN (SP)
From TH - 30 AT 5 FEET

GRAVEL 11 % SAND 86 %
SILT & CLAY 3 % LIQUID LIMIT - %
PLASTICITY INDEX - %

Gradation Test Results

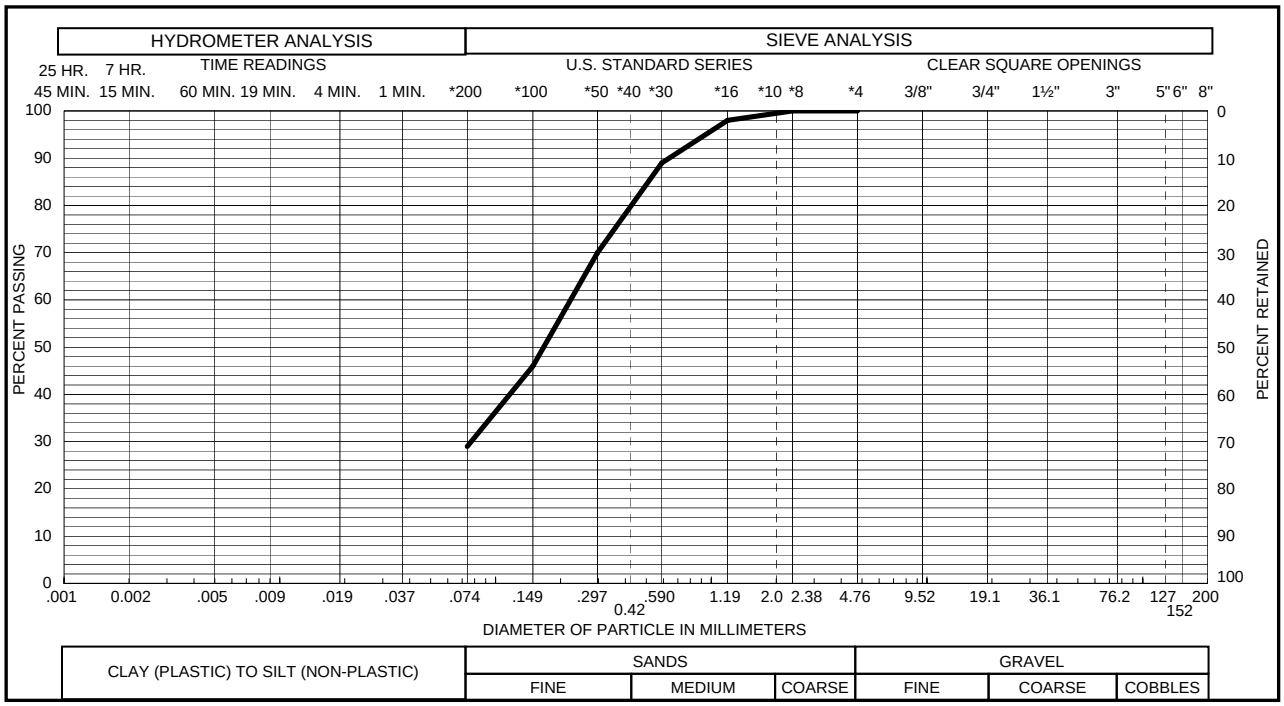
FIG. B-13

EDAW/AECOM
BORROW FILL SOIL INVESTIGATION
CHATFIELD RESERVOIR STORAGE REALLOCATION PROJECT
PROJECT NO. DN44,189-115
S:\PROJECTS\44100\DN44189.000\115\2. Reports\R1\dn44189-115-r1-x1(grad)



Sample of SAND, SILTY (SM)
From TH - 32 AT 3 FEET

GRAVEL 0 % SAND 72 %
SILT & CLAY 28 % LIQUID LIMIT - %
PLASTICITY INDEX - %

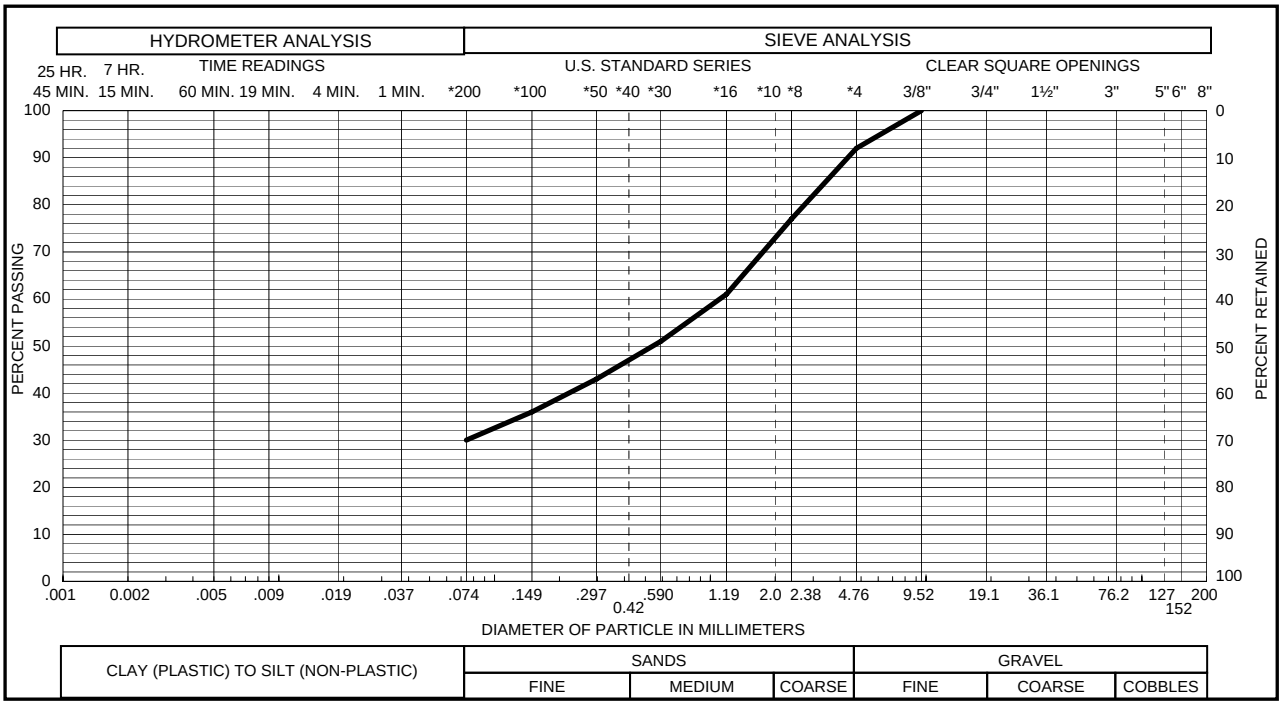


Sample of SAND, SILTY (SM)
From TH - 33 AT 4 FEET

GRAVEL 0 % SAND 71 %
SILT & CLAY 29 % LIQUID LIMIT - %
PLASTICITY INDEX - %

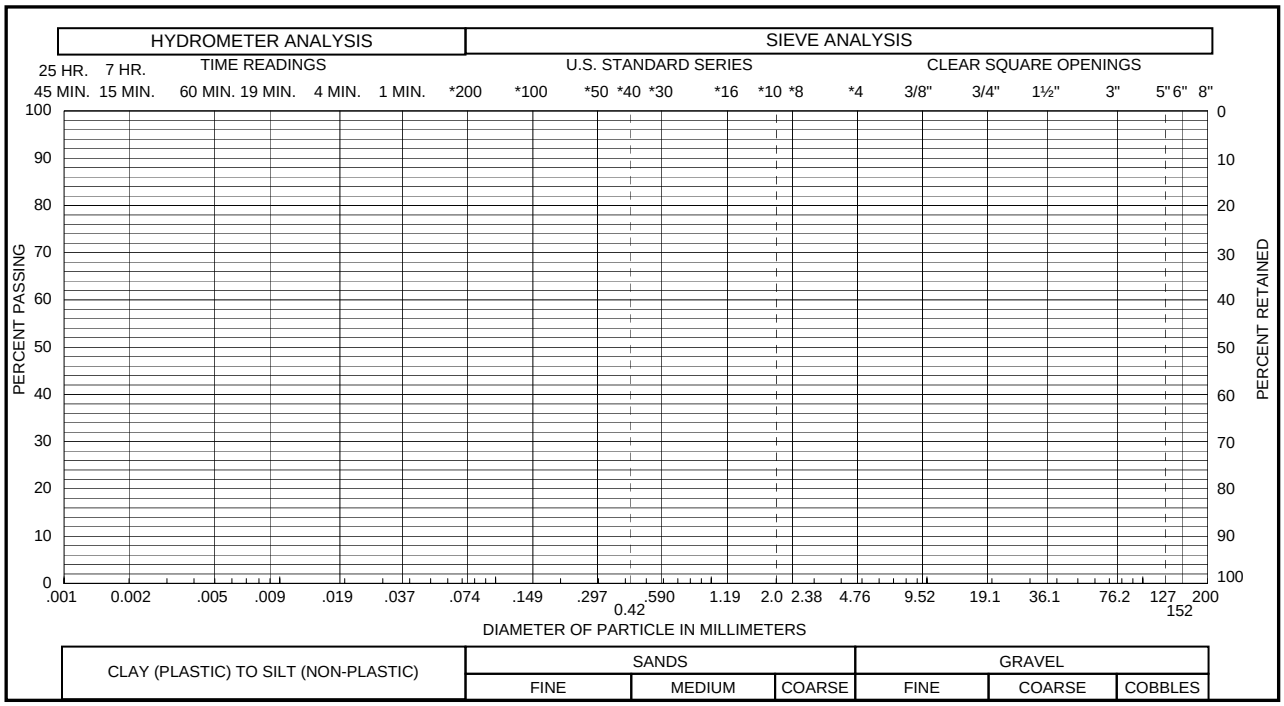
Gradation Test Results

FIG. B-14



Sample of SAND, CLAYEY (SC)
From TH - 34 AT 7 FEET

GRAVEL 8 % SAND 62 %
SILT & CLAY 30 % LIQUID LIMIT - %
PLASTICITY INDEX - %



Sample of
From

GRAVEL % SAND %
SILT & CLAY % LIQUID LIMIT %
PLASTICITY INDEX %

Gradation Test Results

FIG. B-15

TABLE B - I

SUMMARY OF LABORATORY TEST RESULTS

BORROW AREA	BORING	DEPTH	MOISTURE CONTENT	DRY DENSITY	SWELL TEST DATA		RESISTIVITY TEST RESULTS			ATTERBERG LIMITS		UNCONFINED COMPRESSIVE STRENGTH	SOLUBLE SULFATE CONTENT	pH	PASSING NO. 200 SIEVE	SOIL TYPE
					SWELL	APPLIED PRESSURE		MOISTURE CONTENT	RESISTIVITY	LIQUID LIMIT	PLASTICITY INDEX					
		(ft)	(%)	(pcf)	(%)	(psf)		(%)	(ohm-cm)	(%)	(%)	(psf)	(%)	(%)	(%)	
1	TH-1	1	4.3	129											17	SAND, SILTY (SM)
1	TH-1	4	10.1	126											36	SAND, SILTY (SM)
1	TH-2	2	2.8	117											7	SAND, SLIGHTLY SILTY (SP-SM)
1	TH-2	4	2.9	96											10	SAND, SLIGHTLY SILTY (SP-SM)
1	TH-3	2	4.6	127											24	SAND, SILTY (SM)
1	TH-3	4	7.4	126											24	SAND, SILTY (SM)
1	TH-3	6	7.1	95											19	SAND, SILTY (SM)
1	TH-4	3	9.5	108											33	SAND, SILTY (SM)
1	TH-4	5	6.9												17	SAND, SILTY (SM)
1	TH-4	7	7.1	109											20	SAND, SILTY (SM)
2	TH-5	2	20.4	96									0.05			CLAY, SANDY (CL)
2	TH-5	4	16.6	108						59	41				95	CLAY, SANDY (CL)
2	TH-6	2	14.9	95												CLAY, SANDY (CL)
2	TH-6	4	15.4	110												CLAY, SANDY (CL)
2	TH-6	7	20.5	82						57	32				100	CLAY, SANDY (CL)
2	TH-6	9	16.6	106												CLAY, SANDY (CL)
2	TH-7	2	3.8												26	SAND, SILTY (SM)
2	TH-7	4	2.1	107											21	SAND, SILTY (SM)
2	TH-8	1	8.4	95											79	CLAY, SANDY (CL)
2	TH-8	4	2.7	94												SAND, CLAYEY (SC)
2	TH-9	2	5.0	100												SAND, CLAYEY (SC)
2	TH-9	4	6.7	110											38	SAND, CLAYEY (SC)
2	TH-9	7	1.5	118											7	SAND, SLIGHTLY SILTY (SP-SM)
3	TH-10	3	8.5	86												SAND, CLAYEY (SC)
3	TH-10	5	3.2	106											33	SAND, CLAYEY (SC)
3	TH-11	2	8.4	89									0.03			CLAY, SANDY (CL)
3	TH-11	4	10.1	110						39	22				69	CLAY, SANDY (CL)
3	TH-12	2	14.9	93												CLAY, SANDY (CL)
3	TH-12	5	9.8	118						38	23				77	CLAY, SANDY (CL)
3	TH-13	2	10.3	91												CLAY, SANDY (CL)
3	TH-13	4											0.03			CLAY, SANDY (CL)
3	TH-14	2	9.0	97						22	5				59	CLAY, SANDY (CL)
3	TH-14	4	20.7	104												CLAY, SANDY (CL)
3	TH-14	6	20.0	100											57	CLAY, SANDY (CL)
3	TH-15	2	9.8	100												CLAY, SANDY (CL)
3	TH-15	4	9.4	124						35	20				58	CLAY, SANDY (CL)
3	TH-15	7	7.5	110											34	SAND, CLAYEY (SC)
3	TH-15	9	28.8	74												CLAY, SANDY (CL)
3	TH-16	3	17.4	85												CLAY, SANDY (CL)
3	TH-16	5	15.5	111						59	40				89	CLAY, SANDY (CL)
3	TH-16	7	19.9	105												CLAY, SANDY (CL)
3	TH-17	2	16.2	81												CLAY, SANDY (CL)
3	TH-17	4	18.4	105						63	44				97	CLAY, SANDY (CL)
3	TH-17	6	21.3	102												CLAY, SANDY (CL)
4	TH-18	2	4.0	100											20	SAND, CLAYEY (SC)
4	TH-18	4	3.5	110												SAND, CLAYEY (SC)
4	TH-19	2	2.4	100												SAND, CLEAN (SP)
4	TH-19	5	1.2	114											2	SAND, CLEAN (SP)
4	TH-20	2	4.5	98											26	SAND, SILTY (SM)
4	TH-20	4	3.4	109												SAND, SILTY (SM)
4	TH-21	2	3.4	112											21	SAND, SILTY (SM)
4	TH-21	4	2.7	111												SAND, SILTY (SM)
4	TH-22	2	6.3	116						24	10				37	INTERLAYERED CLAY/SAND
4	TH-22	4	4.7	118												INTERLAYERED CLAY/SAND
4	TH-22	6											0.05			INTERLAYERED CLAY/SAND

TABLE B - I

SUMMARY OF LABORATORY TEST RESULTS

BORROW AREA	BORING	DEPTH	MOISTURE CONTENT	DRY DENSITY	SWELL TEST DATA		RESISTIVITY TEST RESULTS			ATTERBERG LIMITS		UNCONFINED COMPRESSIVE STRENGTH	SOLUBLE SULFATE CONTENT	pH	PASSING NO. 200 SIEVE	SOIL TYPE
					SWELL	APPLIED PRESSURE		MOISTURE CONTENT	RESISTIVITY	LIQUID LIMIT	PLASTICITY INDEX					
		(ft)	(%)	(pcf)	(%)	(psf)		(%)	(ohm-cm)	(%)	(%)	(psf)	(%)	(%)	(%)	
4	TH-23	3	3.0	104												SAND, SILTY (SM)
4	TH-23	5	2.6												19	SAND, SILTY (SM)
4	TH-23	7	7.6	116												SAND, SILTY (SM)
4	TH-24	2	2.9	113												SAND, SILTY (SM)
4	TH-24	5	3.7	113											33	SAND, SILTY (SM)
4	TH-25	2	3.3	93											23	SAND, SILTY (SM)
4	TH-25	5	1.8	111												SAND, SILTY (SM)
4	TH-26	2	3.9	102											32	SAND, SILTY (SM)
4	TH-26	4	3.0	106												SAND, SILTY (SM)
4	TH-27	1	5.3	99												SAND, SILTY (SM)
4	TH-27	4	4.1	106											22	SAND, SILTY (SM)
4	TH-28	5	4.4	103												SAND, CLEAN (SP)
5	TH-29	1	1.5	112											10	SAND, SLIGHTLY SILTY (SP-SM)
5	TH-29	3	2.1	111												SAND, CLEAN (SP)
5	TH-29	5	2.1	112											9	SAND, SLIGHTLY SILTY (SP-SM)
5	TH-30	3	3.0	98											24	SAND, SILTY (SM)
5	TH-30	5	1.5	112											3	SAND, CLEAN (SP)
5	TH-31	2	12.9	96												SAND, CLAYEY (SC)
5	TH-31	4	9.7												34	SAND, CLAYEY (SC)
5	TH-32	2	3.9	113												SAND, SILTY (SM)
5	TH-32	3	3.6	99											28	SAND, SILTY (SM)
5	TH-32	5	3.7	109											28	SAND, SILTY (SM)
5	TH-32	7	4.1	110												SAND, SILTY (SM)
5	TH-33	2	2.6	108												SAND, SILTY (SM)
5	TH-33	4	5.1	108											29	SAND, SILTY (SM)
5	TH-33	7	8.8	99												SAND, SILTY (SM)
5	TH-33	9	8.2	111												SAND, SILTY (SM)
5	TH-34	4	4.5	106												SAND, CLEAN (SP)
5	TH-34	7	4.6	115											30	SAND, CLEAN (SP)
5	TH-34	9	2.9	127												SAND, CLAYEY (SC)
	Combined #1	0-5	3.1				TRIAL 1	7.1	6,400	22	7		0.02	7.96	30	SAND, SILTY, CLAYEY (SM-SC)
							TRIAL 2	20.5	3,700							SAND, SILTY, CLAYEY (SM-SC)
	Combined #2	0-5					TRIAL 1	14.1	1,900	38	19		0.01	8.09	70	CLAY, SANDY (CL)
							TRIAL 2	35.1	1,400							CLAY, SANDY (CL)
	Combined #2	0-5	15.4	104								4,700				CLAY, SANDY (CL)
	Combined #2	0-5	17.4	105								3,600				CLAY, SANDY (CL)
	Combined #2		16.2	103	1.2	200										REMOLDED CLAY, SANDY (CL)
	Combined #2		18.0	103	1.1	200										REMOLDED CLAY, SANDY (CL)
	Combined #2		16.4	103	1.2	500										REMOLDED CLAY, SANDY (CL)
	Combined #2		18.1	103	0.5	500										REMOLDED CLAY, SANDY (CL)
	Combined #2		16.7	103	0.2	1,000										REMOLDED CLAY, SANDY (CL)
	Combined #2		17.9	103	0.1	1,000										REMOLDED CLAY, SANDY (CL)
	Combined #3	0-5					TRIAL 1	10.10	3,800	27	12		0.01	7.78	50	CLAY/SAND (CL OR SC)
							TRIAL 2	28.10	2,000							CLAY/SAND (CL OR SC)
	Combined #3	0-5	11.7	110								4,200				CLAY/SAND (CL OR SC)
	Combined #3	0-5	13.7	110								3,000				CLAY/SAND (CL OR SC)
	Combined #3		13.7	109	0.6	200										REMOLDED CLAY/SAND (CL OR SC)
	Combined #3		11.9	109	0.7	200										REMOLDED CLAY/SAND (CL OR SC)
	Combined #3		11.9	109	0.3	500										REMOLDED CLAY/SAND (CL OR SC)
	Combined #3		13.7	109	0.2	500										REMOLDED CLAY/SAND (CL OR SC)
	Combined #3		11.9	108	0.1	1,000										REMOLDED CLAY/SAND (CL OR SC)
	Combined #3		13.7	109	0.1	1,000										REMOLDED CLAY/SAND (CL OR SC)

Notes: Combined #1 contained soil from TH-2, TH-8, TH-20, TH-25 and TH-30
Combined #2 contained soil from TH-5, TH-6, TH-11, TH-13 and TH-16
Combined #3 contained soil from TH-10, TH-14, TH-15, TH-17, TH-22 and TH-23