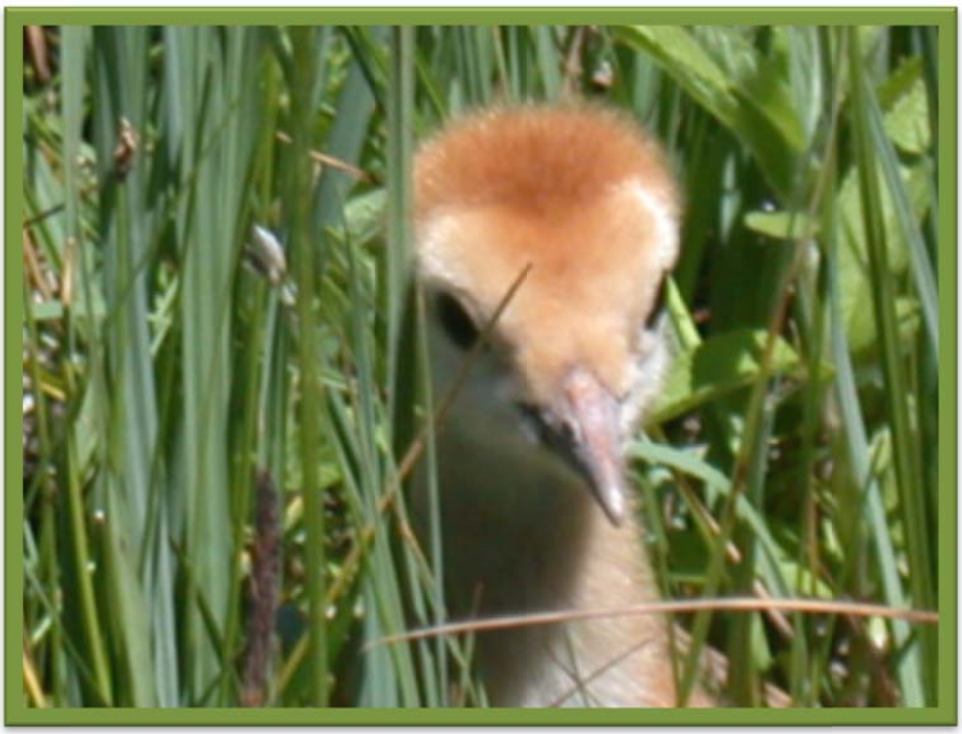
Cutler Hydroelectric Project

FERC Project No. 2420



Resource Management Plan Five-Year Monitoring Report 2008-2012: Final

March 2013

PACIFICORP
A MIDAMERICAN ENERGY HOLDINGS COMPANY

Cutler Hydroelectric Project
FERC Project No. 2420
Box Elder and Cache Counties, Utah

Resource Management Plan
Five-Year Monitoring Report
2008-2012 - Final

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Cover photo: Sandhill crane chick in South Marsh pasture. Photo courtesy of Scott Pratt.

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ATV	All-Terrain Vehicle
COE	United States Army Corps of Engineers
CRP	Conservation Reserve Program
DO	Dissolved Oxygen
FERC	Federal Energy Regulatory Commission
GIS	Geographic Information System
GPS	Global Positioning Satellite
NGO	Non-Governmental Organization
NRCS	Natural Resources Conservation Service
O&M	Operation and Maintenance
RMP	Resource Management Plan
RR	Railroad
TMDL	Total Maximum Daily Load
UDEQ	Utah Department of Environmental Quality
UDWR	Utah Division of Wildlife Resources
USFWS	U.S. Fish and Wildlife Service

Executive Summary

This Five-Year Monitoring Report for Cutler Hydro Project No. 2420 was prepared by PacifiCorp to meet Federal Energy Regulatory Commission (FERC) licensing requirements for Cutler Reservoir, located in Cache and Box Elder Counties, Utah. The project boundaries cover approximately 9,191 acres and surround Cutler Reservoir, including the areas of confluence with its major tributaries: the Bear, Little Bear, and Logan rivers; Spring Creek; and Clay Slough.

This report covers the five-year period between 2008 and 2012, inclusive. During this time, implementation of the Cutler Hydro Project Resource Management Plan (RMP) (PacifiCorp 1995) was complete, and the project continued in the operations and maintenance (O&M) and monitoring phase as stipulated by Article 402 of the FERC license order. This O&M and monitoring phase will continue for the remainder of the 30-year license period, which is in effect until 2024.

The report is organized into three main sections: Section 1) RMP Project Summary to Date, which presents a summary of the original RMP requirements and completed project implementation activities, as well as a summary of the previous five-year report monitoring results; Section 2) Monitoring Results, which summarizes the current report period (2008-2012) RMP monitoring results; and Section 3) Plan and Schedule, which outlines future project monitoring, including proposed plan changes.

RMP Project Summary to Date

Five goals were documented in the PacifiCorp 1995 RMP:

- Improve water quality
- Improve wildlife habitat
- Improve scenic resources
- Retain and improve traditional agricultural uses
- Improve recreational access to the project area

The following programs were developed to meet these goals, and this report is structured to address each of the program components, per the first and second Cutler five-year reports (PacifiCorp 2002 and 2008):

- Vegetation enhancement program, with the following program sub-components:
  - ❖ Shoreline buffer establishment
  - ❖ Shrub planting (woody vegetation pockets and buffer shrub plots)
  - ❖ Bank stabilization
  - ❖ Fencing (buffer/boundary fencing)
  - ❖ Erosion control sediment basins
  - ❖ Sensitive/unique wildlife habitats

- Agricultural lease program, with the following program sub-components:
    - Grazing leases
    - Farming leases
    - Wildlife food/cover plots
    - Cattle management fences
    - Property coordination
- Recreation site development program
- Wetland mitigation area program
- Fish habitat structure program
- Water quality monitoring program
- Water level monitoring program

The implementation phase for the programs listed above was largely complete at the end of the first monitoring report period in late 2002, although several property negotiations undertaken to resolve boundary issues with adjacent landowners were still incomplete due to pending legal actions. These issues were largely resolved during the 2003-2007 report period, and related implementation activities undertaken during this time included marking the new property boundary and integrating the resulting new buffer segments into on-going monitoring activities. Also, the completion of the new project boundary line allowed for the drafting of a new Cutler Project Exhibit G, which was submitted concurrently with the second Cutler five-year report in early 2008, as well as a new Cutler Reservoir boating policy that was implemented during the 2003-2008 report period, but was formally adopted as law in Utah Code shortly after the 2008 five-year report was submitted to the FERC. The final remaining major implementation activity—development of one primitive recreation site—was completed during the 2008-2012 monitoring period after being deferred until 2010 by UDOT and PacifiCorp request, and subsequent FERC orders.

Monitoring Results

The RMP required monitoring to gauge the success and stability of the seven programs implemented. A monitoring plan was developed during the initial reporting period (PacifiCorp 2002), and monitoring proved to be a good mechanism for tracking the condition of the RMP components over time. This monitoring was utilized for both the second and this most recent monitoring period, with very minor changes detailed in the second five-year report (PacifiCorp 2008) and in this report. Findings and recommendations from this monitoring are summarized in Table ES-1.

Plan and Schedule

Monitoring during 2013-2017 will follow protocols established in the 2002 five-year report. Only minor changes are suggested to the original monitoring protocols, including adjusting the frequency of wildlife food and cover plot monitoring from semi-annual to annual (as specified in the 2008 report), and—per agreement with Utah Division of Wildlife Resources—suspension of the fish habitat structure monitoring during major reservoir drawdowns. Water quality monitoring (Appendix G) will continue to be conducted quarterly every fifth year; the next water quality monitoring period begins in 2013. Monitoring of the wetland mitigation site has been discontinued as this program is now complete.

Table ES-1. Summary of Work Completed to Date and Recommendations for Cutler Hydro Project No. 2420.

RMP Program/ Component	**Implementation Required**	**Implementation Completed**	**Findings/ Recommendations**
Vegetation Enhancement			
Shoreline Buffer	Establish 125 acres of shoreline buffer. Of this, a minimum of 50 acres should be converted from tilled land to permanent grass buffer.	Approximately 1440 acres of buffer covering 51.7 miles of shoreline have been established, including 610 acres of tilled land converted to permanent grass buffer (necessary to improve water quality). Implementation complete.	Annual monitoring will continue as present on 54 total buffer segments. Eight buffers rated as fair, at-risk or poor have been prioritized for corrective action. Remaining 46 buffers (85 percent) were rated fair, good or excellent.
Woody Vegetation Pockets	Establish 10-15 pockets 0.5-2.0 acres in size.	Planted 14 (three rated as failed/abandoned to date) pockets at a density of 5000 shrubs/ acre. Goal is at least 10 sites established. Implementation complete.	Annual monitoring will continue as present. Six sites (55%) rated as established. Two new sites added in 2008 to compensate for two failed sites rated as good. Two sites will be evaluated in 2013 for augmentation/ replacement.

Table ES-1. Summary of Work Completed to Date and Recommendations for Cutler Hydro Project No. 2420.

RMP Program/ Component	Implementation Required	Implementation Completed	Findings/ Recommendations
Bank Stabilization	Stabilize 3.5 miles of shoreline	Stabilized 4.42 miles of shoreline. An additional 1.1 miles stabilized at Railroad (RR) Trail as part of the recreation site development program. Implementation complete.	Annual monitoring will continue as present. All but one bank stabilization site in good condition. One bank stabilization site failed and was replaced and expanded at same location during 2011, bringing the new bank stabilization total to 4.44 miles (increased the bank stabilized by 70 feet) plus 1.1 miles of stabilized shoreline on the RR Trail dike. The new site is in good condition structurally, but the vegetation is still establishing.
Boundary/Buffer Fence	Construct 6 miles of additional fence to create/protect the boundary or buffer	Constructed 60 miles of fence (necessary to protect project boundary from unauthorized uses). Implementation complete.	Annual monitoring will continue as present. Most fences in good working condition. Some areas where boundaries are marked with posts need to be repaired or replaced during upcoming monitoring period. Project boundary at the south side of Cutler Canyon surveyed in 2012 and scheduled to be delineated during 2013-15.

Table ES-1. Summary of Work Completed to Date and Recommendations for Cutler Hydro Project No. 2420.			
RMP Program/ Component	**Implementation Required**	**Implementation Completed**	**Findings/ Recommendations**
Erosion Control Sedimentation Basins	Build erosion control catch basins where needed in North Marsh and Reservoir Units.	Constructed 13 erosion control catch basins. Implementation complete.	Annual monitoring will continue as present. All but one site in good condition. Redesign being considered for Basin 3. Monitoring following an average water year, as opposed to the recent period of drought, will be important.
Sensitive/Unique Wildlife Habitats	Protect sensitive wildlife habitats.	Fenced colonial nesting bird habitats, provided artificial nest structures for osprey and owls, implemented Recreation Use Policy and new state regulations (including a new trapping program), and planted roses and other shrubs along RR dike. Implementation complete.	Annual monitoring will continue as present. Additional studies of water quality and the decline in macroinvertebrates in areas of the north marsh near the historic white-faced ibis rookery are being considered by UDEQ; PacifiCorp will participate in the study and ongoing TMDL implementation.
Agricultural Lease			
Land Use Practices (monitored & managed as part of leases, below)		Complete for grazing, farming, and wildlife food/cover leases. Reduced current leases to at most 2,841 acres. Implementation complete.	Need to ensure GIS database updates with current property lease files.

Table ES-1. Summary of Work Completed to Date and Recommendations for Cutler Hydro Project No. 2420.

RMP Program/ Component	Implementation Required	Implementation Completed	Findings/ Recommendations
Grazing	Evaluate practices and incorporate new conditions into grazing leases.	Incorporated new practices into leases affecting up to 2,396 acres (of which up to 663 acres can be grazed for wildlife food/cover plots). Leases reconfigured to improve practices. Implementation complete.	Annual monitoring will continue as present. Grazing program pastures currently cover 1733 acres, with up to another 663 acres potentially grazed as part of the wildlife food/cover plots. 76% of pastures in good or fair condition; 34% in poor or at-risk condition (averaged over the monitoring period).
Farming	Evaluate practices and incorporate new conditions into farming leases.	Incorporated new practices into leases affecting 445 acres. Implementation complete.	Annual monitoring will continue as present. Additional or replacement buffer post markers will be installed as needed.
Wildlife Food/Cover	Evaluate practices and incorporate new conditions into wildlife food/cover leases.	Currently managing up to nine fields for wildlife food/cover. Implementation complete.	Continue spring only annual monitoring.
Cattle Management Fence	Construct 6 miles of fence to control cattle/conflicting uses (an additional 6 miles was required in a separate category).	Constructed 21 miles of fencing (necessary to control grazing impacts to shoreline and pastures). Implementation complete.	Annual monitoring will continue as present.
Property Coordination	Resolve property and boundary issues.	Most boundary issues noted in 2002 and 2008 five-year report resolved. New Exhibit G filed in 2008. Chronic and new encroachments continue to be managed through property incident process and civil court, as necessary. Implementation complete.	Annual monitoring will continue as present. Recommend entering property coordination into PacifiCorp's Hydro License Compliance Tracking spreadsheet. On-going encroachment issues (currently 10 [5%]) will be monitored and corrected through property incident process.

Table ES-1. Summary of Work Completed to Date and Recommendations for Cutler Hydro Project No. 2420.			
RMP Program/ Component	**Implementation Required**	**Implementation Completed**	**Findings/ Recommendations**
Recreation Site Development	Establish: 8 day-use sites (4 developed, 4 primitive) 2 boat-in picnic sites 1 pedestrian loop trail and bridge 2 canoe trails Conduct a visitor use survey	Completed: 8 day-use sites (4 developed, 4 primitive—last site, Logan River Access, completed in 2010) 2 boat-in picnic sites 1 pedestrian loop trail and bridge and 1 point to point pedestrian trail. 3 canoe trails Canoe trail marker system replaced with reflector poles. Interpretive signage and information provided. New recreation use policy and trapping policy instituted. Visitor use survey completed. Implementation complete.	Annual monitoring will continue as present. New Logan River site is popular with recreationists; use at all recreation sites continues to grow. Cutler recreation sites (Logan River site did not exist at last sampling) collectively provide 87,450 annual recreation user days, with 1,010 peak weekend user days, based on 2009 FERC Form 80 data. Next FERC Form 80 data collection cycle will begin in 2014 and be analyzed and reported in 2015.
Wetland Mitigation Area	Construct a 6-acre wetland complex on state land in South Marsh to serve as mitigation for recreation sites developed.	Completed in spring 2001, approved by COE, and turned over to Utah Division of Wildlife Resources (UDWR) for permanent management.	No future monitoring proposed.
Fish Habitat Structures	Install 4-6 fish habitat structures at two sites.	Installed 30 structures at three sites. Implementation complete.	Monitoring fish habitat structures during major reservoir drawdowns proved ineffective and is proposed to be suspended until an alternative monitoring method is identified; angler use surveys suspended until UDWR determines enough angler use/management issue to warrant.

Table ES-1. Summary of Work Completed to Date and Recommendations for Cutler Hydro Project No. 2420.

RMP Program/ Component	Implementation Required	Implementation Completed	Findings/ Recommendations
Water Quality Monitoring	Conduct quarterly sampling 1996-98. After that, quarterly sampling every 5th year, beginning in 2003. Analysis and results in five-year reports.	As required; summary of 2008 monitoring and full 2008 Water Quality Report (Appendix G) is included.	Monitoring will continue per the current quarterly, five-year intervals, as prescribed by the license. Next water quality data collection period is scheduled to occur in 2013 (to be included in 2018 Cutler five-year report) and will be expanded per recommendations of the 2008 data analysis and review. Future water quality data collection is scheduled to occur in 2018 and 2023.
Water Level Monitoring	Conduct reservoir elevation study. File results of proposed operating plan with FERC	As required. FERC order with modified operating plan received 2002. New order requires annual submission of average elevation data.	Annual monitoring will continue as present. Reservoir level data will be filed with FERC annually and summarized in the five-year report.

INTRODUCTION

This report summarizes the work completed during the 2008-2012 operations and maintenance (O&M) and monitoring phase of the Cutler Hydro Project No. 2420 Resource Management Plan (RMP) (PacifiCorp 1995), stipulated by Article 402 of the Federal Energy Regulatory Commission (FERC) license order. This O&M and monitoring work will continue for the remainder of the 30-year license period, until 2024. Details regarding project implementation and initial monitoring activities were presented in the 2002 Cutler Five-Year Monitoring Report (PacifiCorp 2002); minor changes to the 2002 version monitoring plan as well as details of subsequent additional implementation were presented in the 2008 Cutler Five-Year Monitoring Report (PacifiCorp 2008).

The project is located in northern Utah, along the west side of Cache Valley, mostly in Cache County although the dam itself is located in Box Elder County (Figure i-1). The RMP project boundaries cover approximately 9,191 acres and surround Cutler Reservoir, including the areas of confluence with its major tributaries: the Bear, Little Bear, and Logan rivers; Spring Creek; and Clay Slough.

Management and monitoring actions summarized herein were conducted to meet a combination of requirements from the FERC license, and the FERC-required and approved RMP. Although most project implementation actions were complete prior to the first project five-year report, several property negotiations undertaken to resolve boundary issues with adjacent landowners were still incomplete due to pending legal actions. These issues were resolved during the 2003-2007 report period, and related implementation activities undertaken during this time included marking the new property boundary and integrating the resulting new buffer segments into on-going monitoring activities. Also, the completion of the new project boundary line allowed for the drafting of a new Cutler Project Exhibit G, which was submitted concurrently with the second Cutler five-year report in early 2008, as well as a new Cutler Reservoir boating policy that was implemented during the 2003-2008 report period, but was formally adopted as law in Utah Code shortly after the final 2008 five-year report was submitted.

This report also summarizes activities related to the on-going reservoir water level and water quality program monitoring activities. As required by the FERC, this report was submitted to relevant federal, state and local agencies for review prior to submittal to the FERC. Agency correspondence is included in Appendix I.

This report is organized into three main sections:

Section 1.0 – RMP Project Summary to Date (implementation phase [1995-2002] through 2012) - A summary of the original RMP requirements and completed project implementation activities, as well as a summary of the previous five-year report monitoring results.

Section 2.0 – Monitoring Results - A summary of current report period (2008-2012) RMP monitoring results.

Section 3.0 – Plan and Schedule - An outline for future project monitoring, including proposed plan changes.

The organization of this report will follow that presented in the initial Cutler five-year report (PacifiCorp 2002), generally by program heading and management unit; as previously noted in that report, the organization is necessarily different from that of the initial RMP due to the focus on project monitoring that will continue through the license term (2024).

Figures i-1 and 1-1 show locations of the RMP components implemented and management units; additional maps comparing actual current implementation actions with those proposed in conceptual RMP drawings (PacifiCorp 1995) are included in Appendix A ('B' series and 'A' series, respectively).

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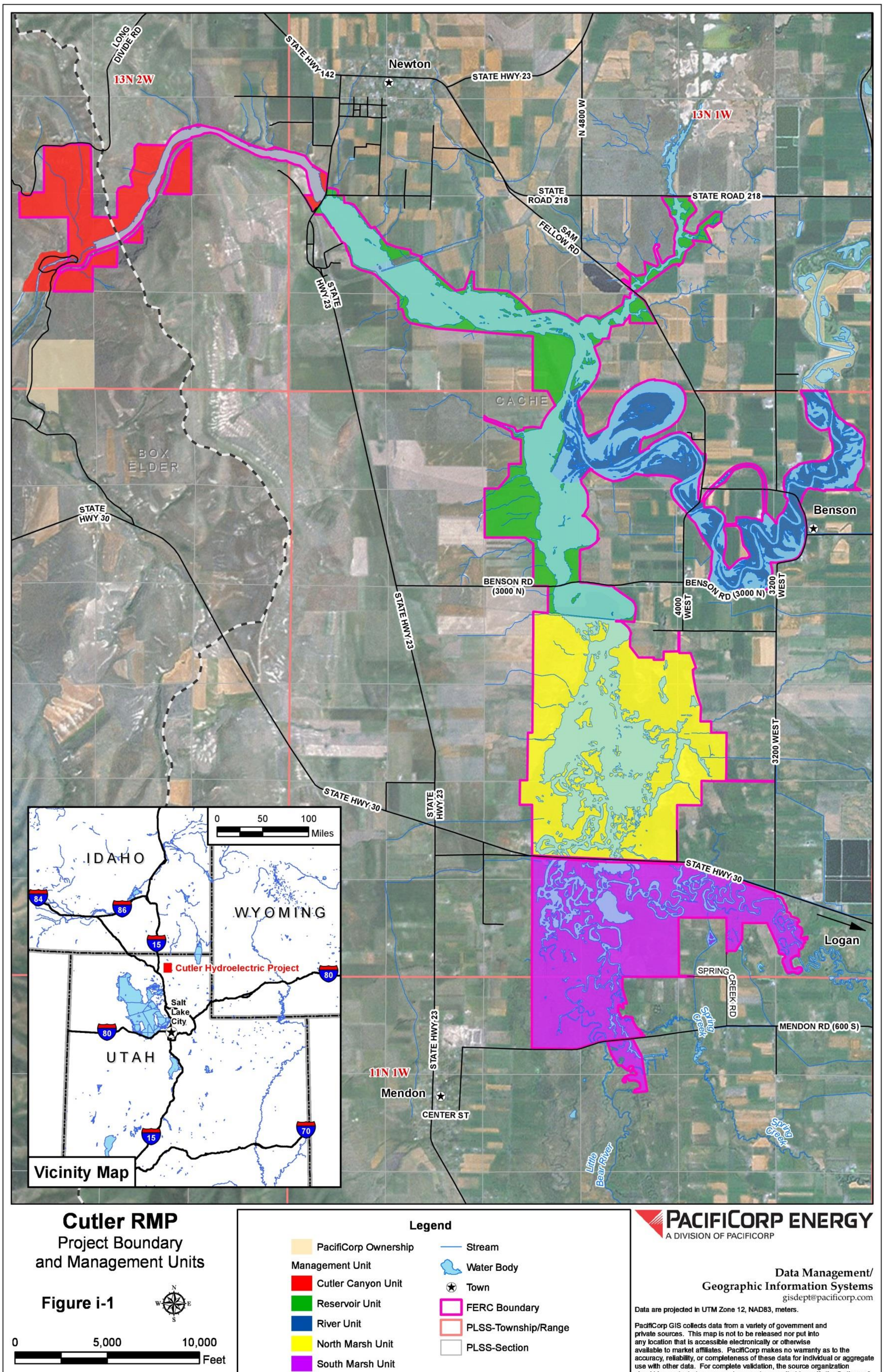


Cutler RMP
Project Boundary
and Management Units

Figure i-1

1.0 CUTLER RMP PROJECT SUMMARY

This section summarizes the completed project implementation activities conducted to meet the original RMP requirements, as well as a summary of the baseline (2002) and most recent (2003-2007) monitoring results, for ease of comparison with the current (2008-2012) monitoring period results presented in Section 2.0. This report provides on-going assurance of compliance with the FERC's license order requiring the development and implementation of the Cutler RMP, and the resultant monitoring reports at five-year intervals through the license period. Subsequent reports are currently proposed to be submitted in 2018, 2023, and 2025 (for the 2013-2017, 2018-2022, and 2023-2024 periods, respectively).

Initial implementation activities were conducted from 1993-2001, with the exception of final resolution of several property boundary determinations that required either continuing negotiations or legal actions. These issues were largely resolved during the 2003-2007 report period, and related implementation activities undertaken during this time included marking the new property boundary and integrating the resulting new buffer segments into ongoing monitoring activities. Also, the completion of the new project boundary line allowed for the drafting of a new Cutler Project Exhibit G, which was submitted concurrently with the second Cutler five-year report in early 2008, as well as a new Cutler Reservoir boating policy that was implemented during the 2003-2008 report period, but was formally adopted as law in Utah Code shortly after the final 2008 five-year report was submitted. The final remaining major implementation activity—development of one primitive recreation site—was completed during the 2008-2012 monitoring period after being deferred until 2010 by PacifiCorp and UDOT request, and subsequent FERC orders. These initial implementation actions are now complete. An additional minor new implementation activity included the development and establishment of a new trapping program in 2012 as a result of an unfortunate accident involving a Cutler visitor's dog. The final new implementation activity required is the fencing (the survey was completed in 2012) or other appropriate delineation of the property boundary around three small parcels located on the south side of Cutler Canyon; this activity will be budgeted and prioritized during the next reporting period.

A monitoring plan was developed during the initial reporting period (PacifiCorp 2002), and this monitoring proved to be a good mechanism for tracking the condition of the RMP components over time. This monitoring, with very minor changes detailed in the second five-year report (PacifiCorp 2008) and in this report, was utilized for both the second and this most recent monitoring period. Monitoring plans are summarized in Section 1.2. Initial (2002) and most recent (2008) monitoring results are included in Section 1.3, for comparison with the current monitoring results, detailed in Section 2.0 of this report.

Monitoring conducted during the previous reporting periods indicated the need for several larger replacement projects after initial mitigation efforts at one bank stabilization and two woody vegetation pocket sites failed. Due to site conditions, the decision was made to replace the bank stabilization site in the same location (although it was expanded somewhat in terms of linear feet stabilized), but the two woody vegetation pockets were abandoned and moved to new sites with better soil conditions. Other maintenance work conducted on mitigation components (fence segments, posts that were removed, erosion control check dam sediment removal, sign maintenance, vandalism repair, etc.) during this reporting period (2008-2012) included smaller scale repairs or maintenance rather than whole component replacement.

1.1 RMP Implementation Summary

The original RMP established five goals set as part of the re-licensing process at Cutler, completed in 1994. The new license stipulated development and implementation of the RMP (PacifiCorp 1995), which included descriptions of the five programs undertaken to achieve the goals for the project, set goals for defined management units, and provided the framework for the series of annual reports that detailed work completed to meet project requirements. The RMP also included a preliminary and relatively conceptual set of maps that detailed possible site locations for achieving the required mitigation measures as described in the new license and the RMP. Those maps were included in Appendix A of the 2002 report, along with a set of maps that depict the project 'as built.' Most differences between the conceptual plans and those actually implemented were a result of findings during actual on-site reconnaissance, as many areas were simply not suitable for the activities proposed in the original conceptual plans. Further, as a result of extensive property trades undertaken to straighten boundaries and maximize shoreline buffer ownership as well as minimize ownership of lands unnecessary to the project, the boundaries of many land parcels identified in the conceptual plans for implementation activities were altered once detailed project planning began. This series of comparison maps (the original conceptual drawings paired with the 'as built' versions) were updated for this five-year report and are included in Appendix A.

Five goals were documented in the 1995 RMP:

1) Improve water quality
2) Improve wildlife habitat
3) Improve scenic resources
4) Retain and improve traditional agricultural uses
5) Improve recreational access to the project area

Five programs were developed in order to meet the goals of the RMP:

- Vegetation Enhancement Program
- Agricultural Lease Program
- Recreation Site Development Program
- Wetland Mitigation Area Program
- Fish Habitat Structure Program

Two additional programs were added to meet the overall goals for the RMP (specifically required by license order 402) and other related license articles, bringing the final program list to seven:

- Water Quality Monitoring Program
- Water Level Monitoring Program

This section summarizes work completed for implementation during the current report period (2008-2012) for each of the seven RMP programs listed above. Implementation activities completed in previous reporting periods are detailed in the 2002 and 2008 Cutler five-year reports, respectively, and summarized (along with any new implementation activities) in Table 1-1 of this report. The implementation requirements are described for each component, as defined by the license or RMP guideline from which each was derived. There were a few minor exceptions or modifications to proposed implementation activities for the RMP; exceptions are noted in the descriptions. The management unit in which the activity was performed is also listed. Table 1-1 indicates overall compliance with the license and RMP requirements, and summarizes all the work carried out to meet the various commitments.

Table 1-1. Summary of Implementation and Work Completed To Date for Cutler Hydro Project No. 2420.

RMP Program/ Component	**Implementation Required**	**Work Completed**	**Initial Implementation Complete?**
Vegetation Enhancement			
Shoreline Buffer	Establish 125 acres of shoreline buffer. Of this, a minimum of 50 acres should be converted from tilled land to permanent grass buffer.	Approximately 1440 acres of buffer covering 51.7miles of shoreline have been established, including 610 acres of tilled land converted to permanent grass buffer (necessary to improve water quality).	**Yes**
Woody Vegetation Pockets	Establish 10-15 pockets 0.5 – 3.0 acres in size.	Planted 14 (three rated as failed/abandoned to date) pockets at a density of 5000 shrubs/acre. Goal is at least 10 sites established. Two new sites were planted in 2008 to replace two previously failed sites bringing the current total to 11 active sites and 3 (including the two replaced in 2008) failed/abandoned sites.	**Yes**

Table 1-1. Summary of Implementation and Work Completed To Date for Cutler Hydro Project No. 2420.			
RMP Program/ Component	**Implementation Required**	**Work Completed**	**Initial Implementation Complete?**
Bank Stabilization	Stabilize 3.5 miles of shoreline	Stabilized 4.42 miles of shoreline. An additional 1.1 miles stabilized at RR Trail as part of the recreation site development program. One previously stabilized bank was judged to be failed with initial technique and was re-stabilized and expanded by 70 feet in 2011, bringing the new bank stabilization total to 4.44 plus 1.1 miles, totaling 5.5 miles of stabilized shoreline banks.	**Yes**
Boundary/Buffer Fence	Construct 6 miles of additional fence to create/protect the boundary or buffer	Constructed 60 miles of boundary/buffer fence (necessary to protect project boundary and buffers from unauthorized uses). Project boundary on the south side of Cutler Canyon was surveyed in 2012; line is proposed to be delineated with fence and/or posts in 2013-2015.	**Yes**
Erosion Control Sedimentation Basins	Build erosion control catch basins where needed in North Marsh and Reservoir Units.	Constructed 13 erosion control catch basins. Redesign is being considered for one basin.	**Yes**
Sensitive/Unique Wildlife Habitats	Protect sensitive wildlife habitats.	Fenced colonial nesting bird habitats, provided artificial nest structures for osprey and owls, implemented new Recreation Use Policy and in 2012 a new trapping program, and planted roses and other shrubs along RR dike (rather than along the Rose Oxbow as conceptually proposed).	**Yes**

Table 1-1. Summary of Implementation and Work Completed To Date for Cutler Hydro Project No. 2420.			
RMP Program/ Component	**Implementation Required**	**Work Completed**	**Initial Implementation Complete?**
Agricultural Lease			
Land Use Practices (monitored & managed as part of leases, below)	Evaluate lease practices on 4500 acres and incorporate new conditions into new leases.	Complete for grazing, farming, and wildlife food/cover leases. Reduced current leases to at most 2841 acres.	**Yes**
Grazing	Evaluate practices and incorporate new conditions into grazing leases.	Incorporated new practices into leases affecting up to 2,396 acres (of which up to 663acres can be grazed for wildlife food/cover plots). Leases reconfigured to improve practices.	**Yes**
Farming	Evaluate practices and incorporate new conditions into farming leases (note much of the new shoreline buffer was formerly part of these leases).	Incorporated new practices into leases affecting 445 acres.	**Yes**
Wildlife Food/Cover	Evaluate practices and incorporate new conditions into wildlife food/cover leases.	Currently managing up to nine fields for wildlife food/cover.	**Yes**
Cattle Management Fence	Construct 6 miles of fence to control cattle/conflicting uses (an additional 6 miles was required in a separate category).	Constructed 21 miles of fencing.	**Yes**
Property Coordination	Resolve property and boundary issues.	Resolved most previous issues with adjacent landowners; continue to work on Church Farm case and other trespass or adjoiner concerns as they occur.	**Yes**

Table 1-1. Summary of Implementation and Work Completed To Date for Cutler Hydro Project No. 2420.			
RMP Program/ Component	**Implementation Required**	**Work Completed**	**Initial Implementation Complete?**
Recreation Site Development	Establish: 8 day-use sites (4 developed, 4 primitive) 2 boat-in picnic sites pedestrian loop trail and bridge 2 canoe trails Conduct a visitor use survey	Completed: 8 day-use sites (4 developed, 4 primitive—the new and final Logan River recreation site was constructed in 2010) 2 boat-in picnic sites 1 pedestrian loop trail and fishing access bridge; 1 point-to-point pedestrian trail 3 canoe trails Interpretive signage and information provided New Recreation Use Policy, and in 2012, a new trapping program instituted. Completed visitor use survey	**Yes**
Wetland Mitigation Area	Construct a 6-acre wetland complex on state land in South Marsh to serve as mitigation for recreation sites developed.	Completed in spring 2001, approved by COE, and turned over in 2001 to Utah Division of Wildlife Resources for permanent management.	**Yes**
Fish Habitat Structures	Install 4-6 fish habitat structures at 2 sites.	Installed 30 structures at 3 sites; angler use surveys deferred until sufficient angler numbers/ management issues, by agreement with UDWR.	**Yes**
Water Quality Monitoring	Conduct quarterly sampling 1996-98. After that, quarterly sampling every 5th year, beginning in 2003. Analysis and results in five-year reports.	As required; summary of 2008 monitoring is included. Next monitoring is being conducted in 2013 (future monitoring is currently scheduled to be conducted in 2018 and 2023).	**Yes**
Water Level Monitoring	Conduct reservoir elevation study. File results of proposed operating plan with FERC.	As required. FERC order with modified operating plan received 2002. New order requires annual submission of average elevation data, included for this reporting period in Appendix H.	**Yes**

1.1.1 Vegetation Enhancement Program

The vegetation enhancement program emphasizes re-establishing shoreline buffer vegetation to improve water quality, wildlife habitat, recreation opportunities, and scenic quality. The main components of this program consist of the establishment of vegetated areas to act as shoreline conservation buffers between the reservoir and adjacent farming activities, and shrub planting and bank stabilization activities within this buffer. Historically, much of the shoreline was farmed down to the water's edge, which contributed significantly to soil erosion and associated negative effects on water quality, as well as increasing the ongoing rate of bank loss in some areas. Erosion control basins have been created in the buffers to minimize sheet flow erosion from agricultural lands and reduce sediment and nutrient loading into the reservoir. Fencing or posting the RMP project boundary (see Figure 1-1 and 1-2) and most buffers is another important component of the vegetation enhancement program, in that it helps to protect buffers and associated habitats. Sensitive wildlife habitats (e.g., osprey nest platforms; burrowing owl nest boxes; the great blue heron rookery; the Cutler Canyon spring; and heron, gull, and ibis colonies) have been either created or protected through lease practices, fencing, and access regulations.

All management units are represented to some degree. This program covers the following components:

- Shoreline buffer establishment
- Shrub planting (woody vegetation pockets and buffer shrub plots)
- Bank stabilization
- Fencing (buffer/boundary fencing)

Two additional components were added to this program as part of the 2002 five-year report structuring:

- Erosion control sediment basins
- Sensitive/unique wildlife habitats

Most components in this program were previously completed, and with the two exceptions noted regarding new woody vegetation pockets and a segment of bank re-stabilization, no other new buffer or other vegetation enhancement program components were created during this reporting period. However, the replacement of the two woody vegetation pockets (two new locations) as noted and one bank stabilization site (re-stabilized and expanded in the original location) were indicated by monitoring and completed during the 2008-2012 period (see Table 1-1 for specific requirements and the 2002 and 2008 five-year monitoring reports for additional details).

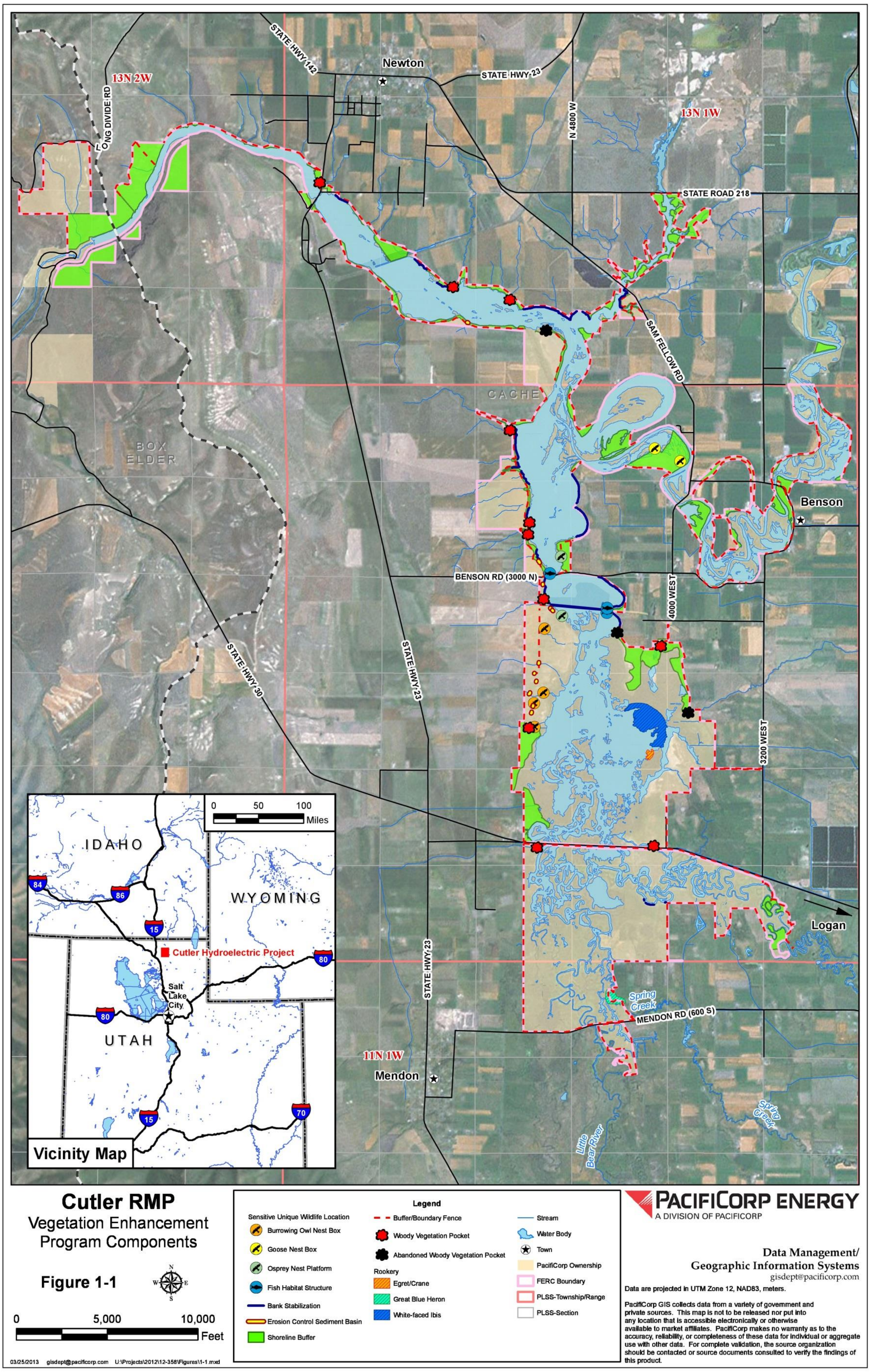
One additional implementation component required surveying and delineation of property boundaries of three small, remote, and relatively inaccessible parcels on the south side of Cutler Canyon. This task was partially completed during this reporting period (see also Table 3-1, 2008 Cutler five-year report). The survey was completed in late 2012; however, boundary and buffer delineation still needs to be completed. This work is currently scheduled for 2013-2015. Monitoring points for the resultant new buffers and boundary/buffer fences will be established following buffer delineation.

All program components have been monitored as proposed or amended in the 2002 and 2008 reports throughout the current report period (see Section 2.0 for current monitoring results). Monitoring results also guided necessary standard O&M work completed during the current report period.

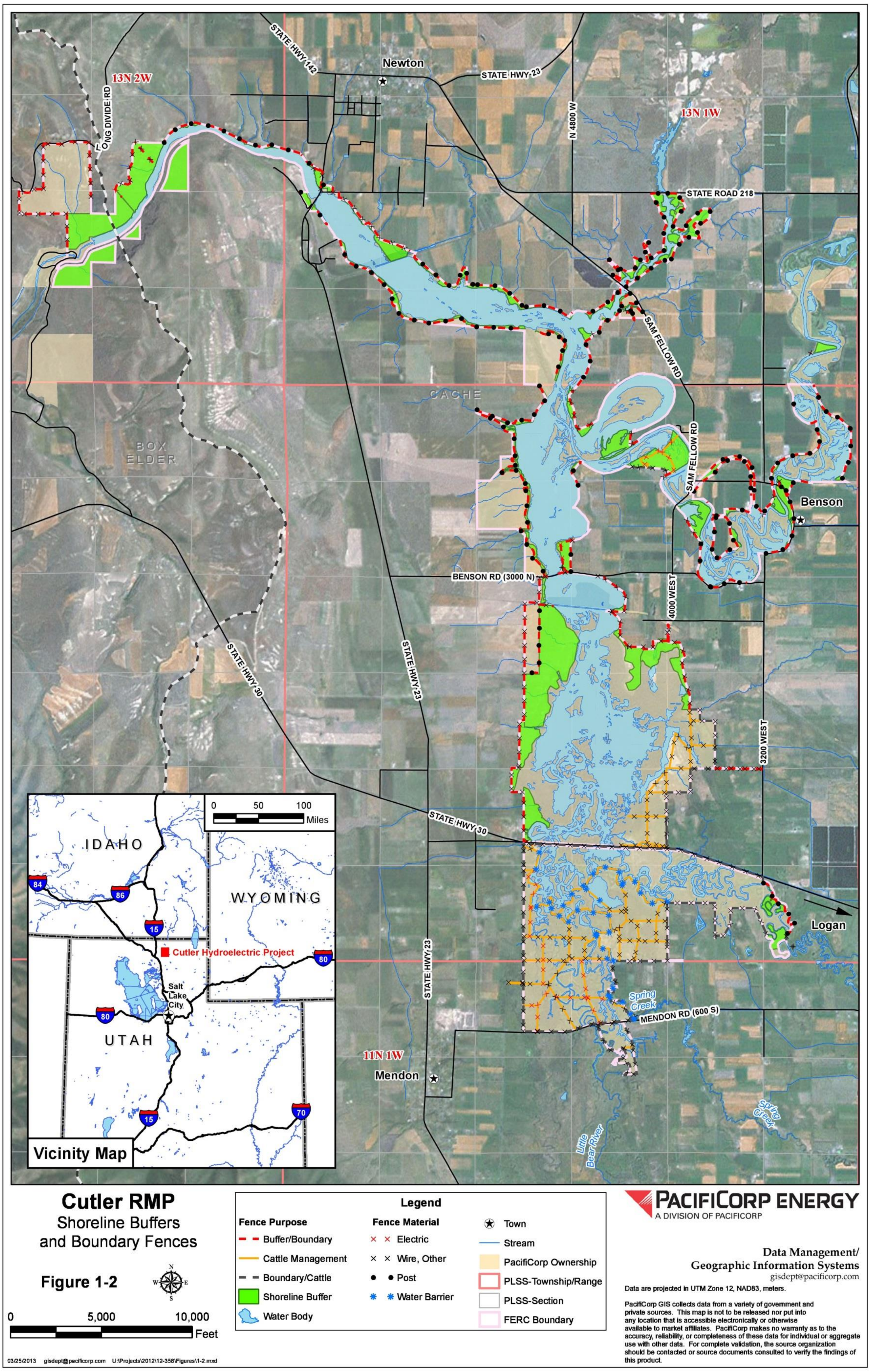
Previous monitoring efforts noted severe and chronic encroachment and trespass issues on two buffers, the Lindley and Church Farm buffers (PacifiCorp 2008). It was ultimately determined that lawsuits would need to be filed to address the concerns. The Lindley buffer has since been rehabilitated and the lawsuit was initially resolved through settlement; however, buffer monitoring has recently shown additional buffer encroachments (see also Section 2.2.5, Property Coordination and related Property Incident Report form summary, Appendix D, Table D-4). Buffer monitoring and routine O&M work such as weed management and post maintenance will continue on the Lindley buffer segment.

Although the Church Farm buffer segment was previously created and fenced, ongoing trespass and fence damage/removal issues and confrontations with the adjoiner continue to be a concern. The fence has been rebuilt numerous times in this and past reporting periods, most recently in late 2012, and has required local law enforcement and legal involvement to simply carry out required monitoring activities. During this reporting period, PacifiCorp filed and won a lawsuit against the adjoiner regarding the ongoing trespass and damage; despite increasing sanctions, the adjoiner has continued to defy the court's orders. PacifiCorp will continue to defend this buffer, fence, and access through additional monitoring, law enforcement, and legal efforts if required. Section 2.2.5, Property Coordination and Appendix D, Table D-4 have additional details and references regarding related property incident reports. Buffer monitoring and access for routine O&M work such as weed management and fence maintenance will likely continue to be a challenge as long as the current adjoiner remains in that area. Section 2.1.1 details other buffer segments that have been prioritized to manage encroachment in the upcoming monitoring period.

Although technically not new implementation, replacing two woody vegetation pockets with two new sites, North Roundy Pump and South Roundy Pump, was completed in the fall of 2008. The two sites were planted to replace sites that failed and were abandoned during the previous monitoring period. Updated woody vegetation pocket location data are reflected in Figure 1-1. Both sites were located in an existing buffer, coincidentally immediately north and south of the Roundy Pump, on the west shore of Cutler in the Reservoir Management Unit. Both sites were planted with a mix of Wood's rose and golden currant shrubs, as those shrubs have proved over many years of planting attempts



Cutler RMP
Vegetation Enhancement Program Components
Figure 1-1



Newton
STATE HWY 142
STATE HWY 23
13N 2W
13N 1W
LONG DIVIDE RD
N 4800 W
STATE ROAD 218
SAM FELLOW RD
CACHE
BOX ELDER
Benson
BENSON RD (3000 N)
4000 WEST
STATE HWY 30
3200 WEST
Logan
Spring Creek
MENDON RD (600 S)
11N 1W
Mendon
Little Bear River
IDAHO
WYOMING
UTAH
Cutler Hydroelectric Project
Salt Lake City
0 50 100 Miles
Vicinity Map
Cutler RMP
Shoreline Buffers and Boundary Fences
Figure 1-2
0 5,000 10,000 Feet
Legend
Fence Purpose
Buffer/Boundary
Cattle Management
Boundary/Cattle
Shoreline Buffer
Water Body
Fence Material
Electric
Wire, Other
Post
Water Barrier
Town
Stream
PacifiCorp Ownership
PLSS-Township/Range
PLSS-Section
FERC Boundary
PACIFICORP ENERGY
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Bank stabilization and repair work completed at the Stewart East site in fall 2011

to be best adapted to growing conditions at Cutler. Both Roundy woody vegetation pocket sites are also located adjacent to existing bank stabilization sites.

Transects were established at the two new woody vegetation pocket sites and both have been monitored since their installation (see also Section 2.1 for monitoring details); careful weed control and other O&M work was conducted as indicated.

Similar to the two new woody vegetation pockets, although technically not new implementation, monitoring during the 2008-2012 period showed that a section of stabilized bank, Stewart East, had failed and needed to be re-stabilized (see also Section 2.1.3 for more detail). In the fall of 2011, approximately 992 feet (70 feet longer than the original bank project) of extensive bank stabilization repair and replacement work was completed on the Stewart East site for a total of 1248 feet for the Stewart East bank as a 256-foot section was intact and left in place along with the 992 feet of re-established bank which was 70 feet longer than the original bank stabilization. As part of this project, once the reservoir bank was re-contoured, a rock rip/rap breakwater was placed 1-2 feet out into the reservoir, the newly created slopes were revegetated, willow bundles were installed linearly and adjacent to the toe of the slope with the rock rip/rap breakwater, and enhancements were completed with the addition of some emergent marsh root wads in the new quietwater zone, and disturbed bank and upland areas were reseeded with an upland perennial grass mixture. The site was visited during the 2012 woody vegetation pocket monitoring, and photopoint baseline data were collected and an overall visual inspection of the site was performed. The site will be monitored with the other bank stabilization sites in future years.

1.1.2 Agricultural Lease Program

As part of the FERC application filed in 1991, PacifiCorp proposed to modify its agricultural leasing program, which consisted of modifying land use and lease practices on 4,500 acres to accomplish land use changes and managing the new leases under three main program components (Figure 1-3):

- Grazing leases
- Farming leases
- Wildlife food/cover leases

Two other components were reassigned to this program as part of the 2002 five-year report structuring:

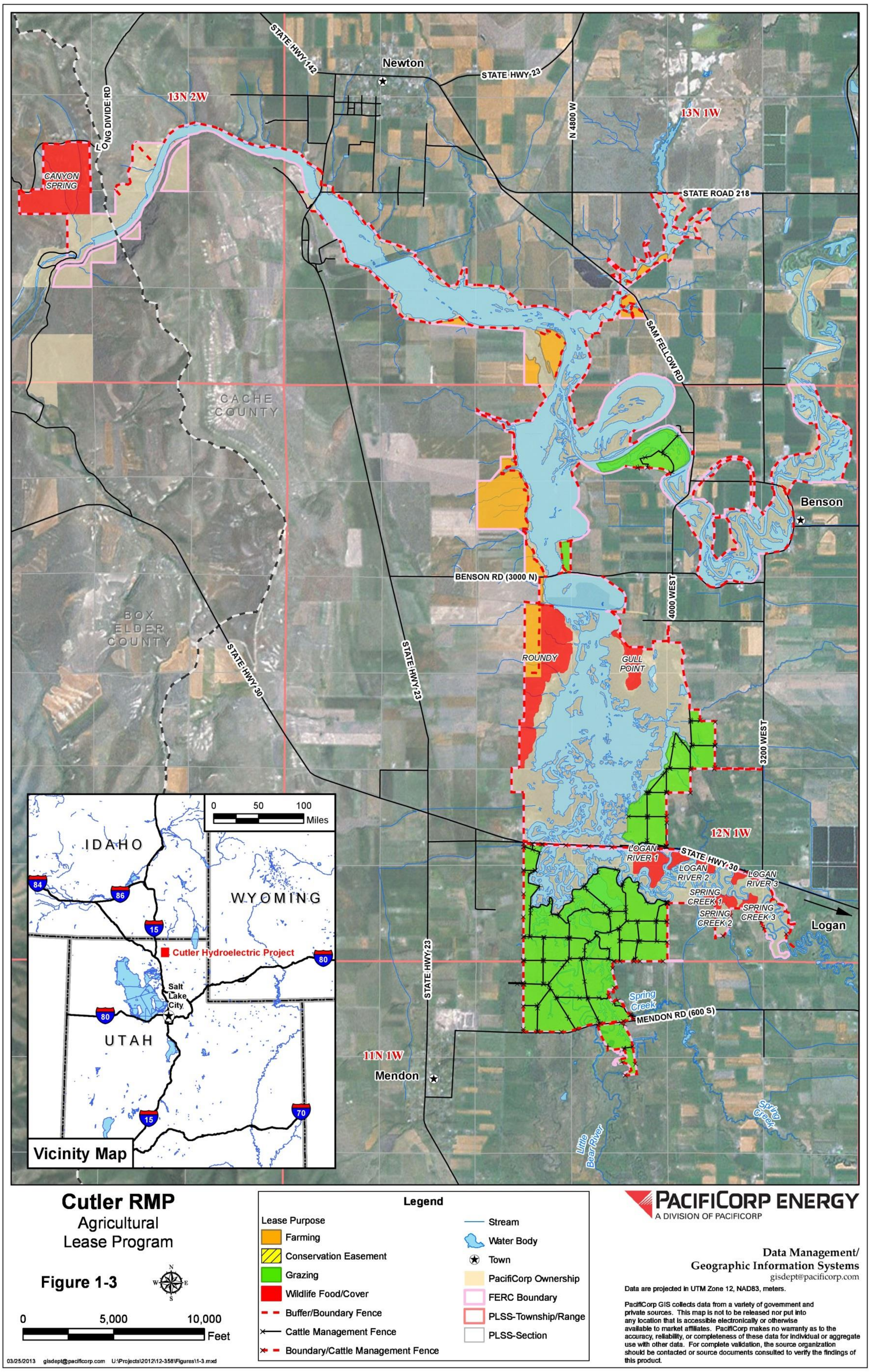
- Cattle management fences
- Property coordination

Note that cattle management fences (Figure 1-3) address a second required category of fence, distinct from the buffer/boundary fences covered in the previous section of this report, to delineate leases and to control grazing. Improvements in land use resulting from implementation of this program have been widespread across all five management areas.

Most components in this program were previously completed (see Table 1-1 for specific requirements and the 2002 and 2008 five-year monitoring reports for additional details) and have been monitored throughout the current report period (see Section 2.0 for current monitoring results). Monitoring results also guided necessary O&M work (primarily fence maintenance and weed control) completed during the current report period. Note that the wildlife food/cover leases, although still included in the agricultural lease sections (Spring Creek and Logan River pastures, Cutler Canyon pasture, and the 300-acre pasture), are actually included with and monitored as part of the Sensitive/Unique Wildlife sections of this report (Section 2.1.6).

The only exceptions to previous completion of implementation for this program include the ongoing property boundary management issues noted previously in Section 1.1.1. Ongoing property boundary resolution is necessary in order to ensure required control of conflicting uses of company land. Because the initial implementation property boundary work has now been completed (the final piece was recorded in 2007), a new Exhibit G to the license was also completed and submitted to the FERC in 2008.

O&M work for this overall program is similar to that laid out in the 2002 five-year report; major O&M work completed in support of this license component is detailed in Section



Newton
STATE HWY 142
STATE HWY 23
13N 2W
13N 1W
LONG DIVIDE RD
N 4800 W
CANYON SPRING
STATE ROAD 218
SAM FELLOW RD
CACHE COUNTY
Benson
BENSON RD (3000 N)
4000 WEST
BOX ELDER COUNTY
STATE HWY 30
STATE HWY 23
ROUNDY
GULL POINT
3200 WEST
12N 1W
LOGAN RIVER 1
LOGAN RIVER 2
LOGAN RIVER 3
SPRING CREEK 1
SPRING CREEK 2
SPRING CREEK 3
Logan
Spring Creek
MENDON RD (600 S)
11N 1W
Mendon
Little Bear River
IDAHO
WYOMING
UTAH
Cutler Hydroelectric Project
Salt Lake City
84
86
15
80
70
0 50 100 Miles
Vicinity Map
Cutler RMP
Agricultural Lease Program
Figure 1-3
0 5,000 10,000 Feet
Legend
Lease Purpose
Farming
Conservation Easement
Grazing
Wildlife Food/Cover
Buffer/Boundary Fence
Cattle Management Fence
Boundary/Cattle Management Fence
Stream
Water Body
Town
PacifiCorp Ownership
FERC Boundary
PLSS-Township/Range
PLSS-Section
PACIFICORP ENERGY
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2.0 of this report, and in the property incident form summary in Appendix D, Table D-4. Resolution of the Cardon (Church Farm) and Lindley lawsuits are major accomplishments for this RMP component, although both have ongoing issues that need to be managed.

1.1.3 Recreation Site Development Program

The RMP stipulates that the recreation site development program improve public access and develop recreation facilities at a number of sites around the reservoir (Figure 1-4). These include a wide range of developed uses, from major (with boat ramps and permanent restroom facilities) to more primitive sites (allowing canoe or other small boat launch only and portable seasonal restroom facilities). Additional recreation developments included construction and/or installation of two boat-in sites, three canoe trails, and two pedestrian trails. Interpretive signing and recreational use regulations are also described as part of this program.

Most components in this program were previously completed (see Table 1-1 for specific requirements and the 2002 and 2008 five-year monitoring reports for additional details) and have been monitored throughout the current report period (see Section 2.3 for current monitoring results). Monitoring results also guided necessary O&M work (primarily fence maintenance and weed control) completed during the current report period.

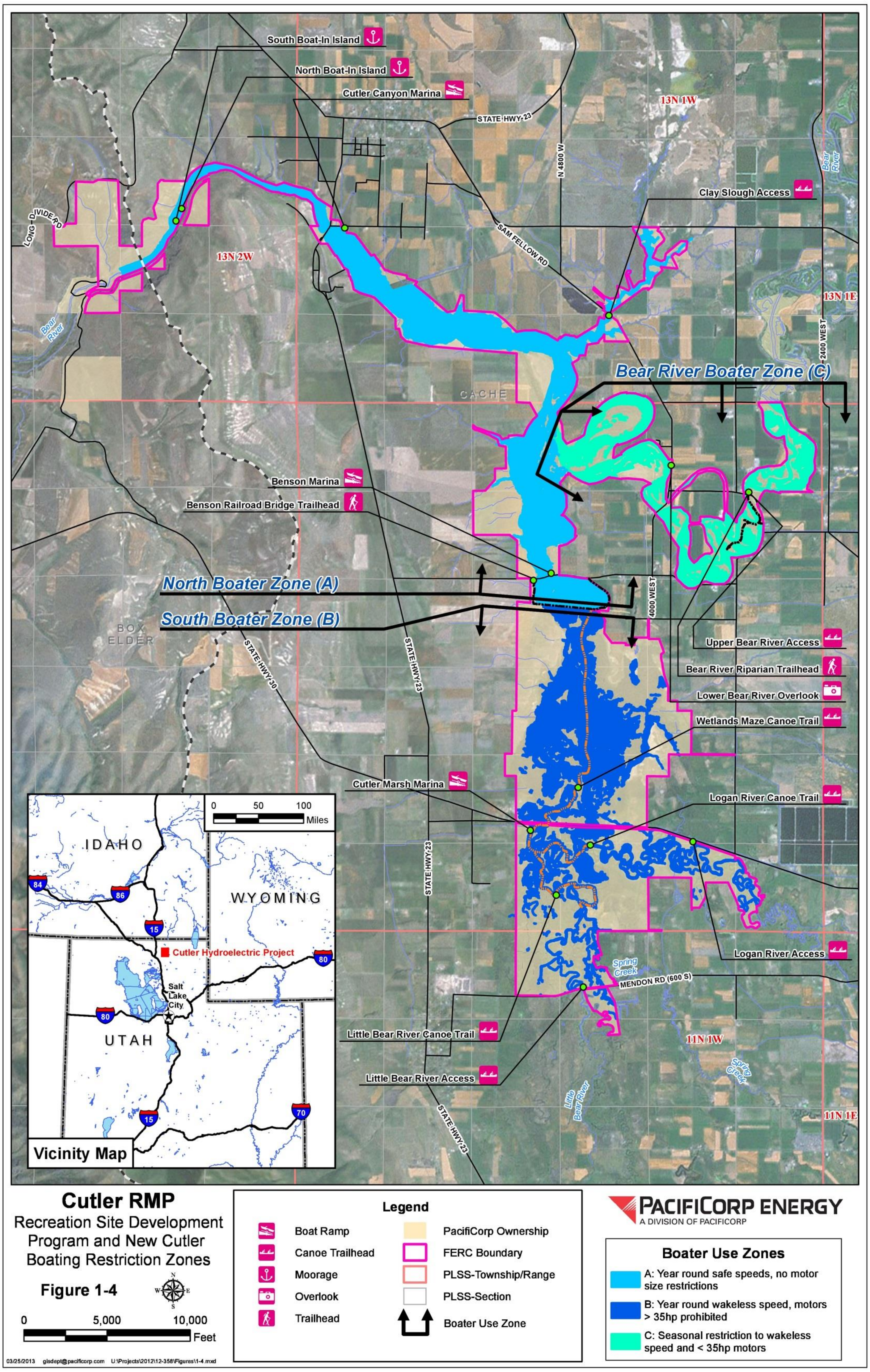
The only exception to previous completion of implementation of this program was the construction of the Logan River recreation site proposed to be located on the south side of the Valley View Highway (State Hwy 30), as a primitive site providing canoe access to the lower reach of the Logan River prior to its confluence with Cutler Reservoir. In the Cutler RMP, PacifiCorp originally proposed to provide a turnout from the highway expansion (to access the new site); however, UDOT indicated that a deceleration/ acceleration lane would be required for public safety. Because of the narrowness of the highway, UDOT would not consider a variance. Further, UDOT expressed an interest in having PacifiCorp wait to construct this site with the required lanes until UDOT engineers could determine the proper road configuration along this very busy stretch of state highway during a proposed future highway expansion (UDOT, pers. comm. 2004). As a result, it was infeasible to move forward with construction of the site as initially proposed, and subsequent orders were issued deferring construction of this site and laying out an agreed-upon alternative schedule of initial implementation.

By 2009 it was clear that UDOT would not be expanding the road on a timetable that would meet the 2010 FERC order deadline; after looking at several alternate locations, it was also clear that no other location would meet the original purpose and need of the site that did not also have the same highway access issues as the original Valley View site. With this information, PacifiCorp conducted a formal traffic study and associated variance request, which it submitted to UDOT in early 2010 (Appendix E-4). UDOT granted the variance, essentially concurring that an acceleration/deceleration lane was not warranted at the site, and the Logan River recreation site was constructed in late 2010 and subsequently opened in early 2011 (see Section 2.3 for more detail). The new recreation

The new Logan River recreation site includes a small boat dock, a parking lot, and a gravel path to the water's edge.

site allows safe canoe access along Highway 30 between Logan City and Cutler Marsh Marina, and includes a UDOT-approved parking pullout. A small boat dock, parking lot, and gravel path to the water's edge have been installed at the site. Several trees, permanent signs and fences, and a concrete pad for a portable restroom were also installed at the new Logan River recreation site.

General O&M work for this program consists of recreation site maintenance per the PacifiCorp 2002 five-year monitoring report (Section 1.3). Major O&M work included adding more gravel and bare ground herbicide treatment at all major parking areas. Damaged signs were repaired and new signs installed where applicable. New signs identifying each recreation site throughout the reservoir were added to existing sign boards; the contents of all boards, including maps, FERC Form 80 information, and new regulations concerning motorized usage in various areas of the reservoir were standardized throughout the area. See Section 2.3 for additional details regarding monitoring activities for recreation sites.



South Boat-In Island
North Boat-In Island
Cutler Canyon Marina
STATE HWY 23
13N 1W
N 4800 W
Clay Slough Access
SAM FELLOW RD
LONG DIVIDE RD
13N 2W
13N 1E
2400 WEST
Bear River
Bear River Boater Zone (C)
CACHE
Benson Marina
Benson Railroad Bridge Trailhead
North Boater Zone (A)
South Boater Zone (B)
4000 WEST
BOX ELDER
STATE HWY 30
Upper Bear River Access
Bear River Riparian Trailhead
Lower Bear River Overlook
Wetlands Maze Canoe Trail
Cutler Marsh Marina
Logan River Canoe Trail
Logan River Access
Spring Creek
MENDON RD (600 S)
Little Bear River Canoe Trail
Little Bear River Access
11N 1W
11N 1E
Little Bear River
IDAHO
WYOMING
UTAH
Cutler Hydroelectric Project
Salt Lake City
0 50 100 Miles
Vicinity Map
Cutler RMP
Recreation Site Development Program and New Cutler Boating Restriction Zones
Figure 1-4
0 5,000 10,000 Feet
Legend
Boat Ramp
Canoe Trailhead
Moorage
Overlook
Trailhead
PacifiCorp Ownership
FERC Boundary
PLSS-Township/Range
PLSS-Section
Boater Use Zone
PACIFICORP ENERGY
A DIVISION OF PACIFICORP
Boater Use Zones
A: Year round safe speeds, no motor size restrictions
B: Year round wakeless speed, motors > 35hp prohibited
C: Seasonal restriction to wakeless speed and < 35hp motors

In 2007, a final component of the recreation site development program, a new Cutler motorized boater access plan and regulations, was completed in conjunction with Utah State Parks and Utah Division of Wildlife Resources (UDWR), and in consultation with numerous boaters, hunters, and environmental interests. This partnership was necessary to ensure adherence to state laws, PacifiCorp license obligations, and RMP direction. Note that only State Parks can regulate boating access in the state, and input from PacifiCorp and UDWR was vital to ensure that the interests of boat recreationists, water skiers, duck hunters, wildlife enthusiasts, canoers, and the protection of several sensitive species' nesting areas were balanced to the degree possible. In November of 2007 the proposed new regulation was adopted by the State Boating Council and State Parks Board; it became part of Utah state law in early 2008 when the legislature reconvened.

The new regulations, which went into effect March 10, 2008 (just after the submittal of the 2008 Cutler five-year report), continue to reduce public impact on sensitive wildlife resources, while allowing popular recreation use of the marsh for canoeing, hunters, birders, and other motorized boating enthusiasts. The regulation stipulates three separate boating zones in the reservoir: in the South zone, motors are limited to 35hp or less and wakeless speeds year round; in the Bear River zone, motors and wakeless speeds are similarly regulated, but only seasonally, generally from the last weekend in September until the end of March; in the North zone, no motor size restriction and safe speeds are in place year round (Figure 1-4). Appendix E-2 includes both the regulation adopted and a copy of the maps in use throughout the reservoir to educate users as to the new policy. Both State Parks and UDWR are committed to providing the necessary enforcement of the new regulation.

One additional new program was put in place after the unfortunate death of a site visitor's companion dog in a trapping snare on PacifiCorp property in early 2012. Based on the potential for future mishaps given the number of recreational dog walkers that visit the project area annually, PacifiCorp consulted with UDWR, and then instituted a by-written-permission-only trapping program. Any trapper may obtain a permit, which is free but seasonal, and permission is limited to underwater trap sets only, or live trapping (with several other related conditions) in order to eliminate the concern for inadvertent trapping of non-target animals on PacifiCorp lands. The permit must be renewed annually. The program meets the required elements to continue to provide PacifiCorp liability protection under the Utah Landowner Liability Act. In the first year the trapping program was available to fur trappers, eight individuals requested and received their written trapping authorization. The UDWR is aware of and supports the program, and will cite any trapper not in possession of the written authorization, in accordance with Utah law and regulations posted at all recreation sites and potential access points to Cutler project lands. A copy of a sample Cutler trapping permission letter is attached in Appendix E-3.

1.1.4 Wetland Mitigation Area Program

Implementation of the original recreation site development program resulted in some unavoidable impacts to wetlands and other special aquatic sites located at the edge of the reservoir where recreation sites were constructed. Although the original construction plans would have affected approximately 2 acres of wetlands, additional avoidance measures were incorporated by altering the site designs, which decreased total wetland impacts to less than 0.25 acres. In order to mitigate these impacts, PacifiCorp proposed construction of a 6.0-acre wetland/pond complex on land adjacent to the project owned by the UDWR, and the removal of an old road in a wetland adjacent to the Upper Bear River recreation site.

The created wetland mitigation site is located just outside PacifiCorp ownership in the South Marsh Management Unit on lands owned by UDWR (see Figure 2-2). PacifiCorp monitored this site as required on an annual basis through 2000. The year 2000 was the end of the final required monitoring season for wetland establishment; management of this wetland was then returned to the landowner, UDWR. The final monitoring report was submitted to, and accepted by, the U.S. Army Corps of Engineers (COE) in the fall of 2000. In the spring of 2001, a site visit was held with UDWR to ensure an appropriate transition following completion of PacifiCorp's project. The final wetland monitoring was included with the 2002 PacifiCorp report, as required by the FERC license.

This program is considered complete; there are no future plans for monitoring or O&M work at this site, as the landowner (UDWR) now has responsibility for the area.

1.1.5 Fish Habitat Structure Program

Implementation of this program was proposed to help increase the number of game fish in the reservoir and provide improved recreational angler opportunities at Cutler Reservoir. Fish habitat structure was noted to be lacking, so artificial habitats (wood and wire 'crappie condos') were designed, constructed, and installed in cooperation with UDWR (see Figure 1-1).

All implementation components of this program were previously completed (see Table 1-1 for specific requirements and the 2002 and 2008 five-year monitoring reports for additional details). The only exceptions to the original RMP were that more fish habitat structures than originally proposed were installed, and that the monitoring plan and schedule were changed per agreement with UDWR as they concurred that reservoir turbidity precluded adequate inspection of the structures while underwater, (1996; see Appendix C, PacifiCorp 2002 for more detail), allowing PacifiCorp to suspend additional fish habitat structure monitoring until the next major drawdown, and angler surveys until angler use increases to a point where adequate data can be collected. One drawdown opportunity for monitoring the fish habitat structures occurred in late fall of 2008; see Section 2.5 for monitoring result details and the resultant proposal to suspend future fish habitat structure monitoring.

Another large-scale drawdown is currently being proposed for fall of 2013; the drawdown is required by the FERC to address issues with the Cutler spill gates and will be of sufficient magnitude to allow work to occur near the bottom of the gates, lowering the elevation at the dam to approximately 4404 feet (the previous 2008 drawdown lowered the reservoir elevation at the dam to approximately 4385 feet; note that a large sediment deposition area at the confluence of the Bear River and Cutler Reservoir prevents uniform elevations during drawdown events and creates a 'slope' on the reservoir during drawdowns; also see Appendix H for summaries of annual reservoir water level data).

As noted in Appendix I, a commenter on the draft version of this report (M. Burns, pers. comm. 2013), requested information regarding the level of angler use that would trigger the angler use (creel) surveys proposed in the Cutler license and associated RMP. Given the involvement by UDWR in any future angler use surveys, PacifiCorp staff discussed the comment with the Division's Northern Region Fisheries Manager (P. Thompson, pers. comm. 2013). The Division noted that they still believe the angler use levels are insufficient to warrant the surveys, but further that angler surveys are generally done to address a specific management issue or question, and that the 'triggering event' would be the issue or question, and not really angler numbers (i.e., questions about the fishing experience at a particular location meeting the goals for that waterbody). If questions regarding the matter still remain, PacifiCorp and UDWR recommend meeting in 2013 to address the issue.

Several Utah State University (USU) fisheries and aquatic ecology classes have undertaken additional monitoring samples and studies in Cutler Reservoir during the 2008-2012 reporting period, covering topics from fish diversity and abundance in the reservoir, to macroinvertebrate sampling and comparisons, and various water quality and limnology assessments (see also Section 2.5 for additional monitoring results). Budy (unpublished data, 2009-2012) has noted the following 12 species as occurring at Cutler Reservoir (several years dominated by fathead minnows and carp, but nearly all fish species were present every year of the surveys; data and additional details in Appendix F): black crappie, black bullhead, bluegill sunfish, brown trout, channel catfish, fathead minnow, common carp, green sunfish, largemouth bass, smallmouth bass, walleye, and Utah sucker (see page 28).

1.1.6 Water Quality Monitoring Program

The goal of this project component was to monitor the effect on water quality of the operational and RMP changes that were designed to ensure water quality in Cutler was not further degraded, and so that improvements to water quality resulting from land management practices on project lands could be tracked. For that to occur, baseline data on water quality had to be established in order to determine if water quality improvements are occurring and what contributions the tributaries to Cutler, most of which are located away from project lands or influence, are making to water quality in Cutler. It is noteworthy that water quality in the tributaries overwhelms any water quality effects of Cutler project land management activities or improvements (SWCA 2010 and PacifiCorp 2008); as a result, over the current reporting period PacifiCorp has been active in the development and implementation of the Cutler Total Maximum Daily Load (TMDL) limit process, and serves as a member of the Cutler TMDL Technical Advisory Committee (TAC). The TMDL TAC meetings have been occurring since 2004 and the TAC has been instrumental in helping to develop and implement the Cutler TMDL

black crappie
(*Pomoxis nigromaculatus*)

black bullhead
(*Ameiurus melas*)

bluegill sunfish
(*Lepomis macrochirus*)

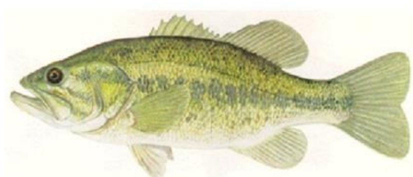
brown trout (*Salmo trutta*)

channel catfish (*Ictalurus punctatus*)

fathead minnow
(*Pimephales promelas)*

common carp
(*Cyprinus carpio*)

green sunfish
(*Lepomis cyanellus*)



largemouth bass (*Micropterus salmoides*)

smallmouth bass (*Micropterus dolomieu*)

walleye (*Sander vitreus*)

Utah sucker (*Catostomus ardens*)

(SWCA 2010), which was accepted by the EPA in 2010 and will result in improvements to the water quality of the reservoir, in part by addressing water quality inputs of the various tributaries, including the Logan City wastewater lagoons, which discharge to the Swift Slough area of Cutler Reservoir.

PacifiCorp's Cutler quarterly water quality sampling was originally required by the license annually for three years, ending with the 2002 report period (see Table 1-1 for specific requirements and the 2002 and 2008 five-year monitoring reports for additional details). Since then, the required frequency for quarterly water quality monitoring shifted to a five-year cycle. The first year of this new monitoring regime was 2003; the most recent was in 2008. Those results are summarized in Section 2.6 of this report (2008 sampling data) and the 2008 report (the 2003 sampling data). The next water quality data collection and analysis cycle to fulfill the water quality monitoring requirements will occur quarterly in 2013, and subsequently in 2018 and 2023. Analysis and results will be submitted with each future Cutler five-year monitoring report.

A new development for Cutler water quality monitoring is the fact that the Utah Department of Environmental Quality (UDEQ) will also be monitoring essentially the same monitoring points at Cutler in its next water quality monitoring efforts for the Cutler TMDL beginning in 2014. This should allow a more robust dataset (monitoring will occur for two full years, by PacifiCorp in 2013, and by UDEQ in 2014) for both parties to better track and potentially address any further impacts or improvements to water quality during the next (2013-2017) Cutler five-year reporting period. The 2017 date also corresponds to Logan City's compliance schedule, when their wastewater effluent will need to meet more stringent nutrient parameters (especially for phosphorus) to be in compliance with their wastewater operating permits.

1.1.7 Water Level Monitoring Program (Cutler Operational Plan)

The original license requirement for this program included the FERC-required Three-Year Bear River Basin Study (PacifiCorp 1999), which was designed to evaluate the ability of the project to operate within the proposed mid-reservoir elevation ranges described in the RMP. PacifiCorp submitted a report to FERC in 1999 which revised the proposed operating elevation range targets; FERC replied with a final modified license article in 2002 that indicated their acceptance of our revised operations plan and water level targets, as well as specifying the dates by which annual monitoring data, comprised of average daily reservoir levels, should be submitted to FERC. Results of the water level monitoring were incorporated into the Three-Year Bear River Basin Study and the Operational Plan for the Cutler Project (see Table 1-1 for specific requirements and the 2002 and 2008 five-year monitoring reports, Section 1.6.5 and Appendix H, Cutler 2002 for additional detail). Table 1-2 presents the modified operating range proposed by PacifiCorp and accepted by FERC Order for Cutler Reservoir elevations (as measured at Cutler Dam).

Table 1-2. Licensee's Condensed Reservoir Elevation Operating Range.			
Time Period	**Operating Range (Elevation in feet)**	**Tolerance (feet)**	**Target Percentage**
March 1 through December 1	4407.5 to 4406.5	+.25, -.25	95%
December 2 through February 28	4407.5 to 4406.0	+.25, -.50	90%

No O&M work is necessary for this program; PacifiCorp monitors the operation of the project and reports annually on compliance with the target ranges at Cutler Dam. As these monitoring reports are submitted separately, they are only summarized in this report (see Section 2.7 and Appendix H of this report for additional detail of this RMP component). Copies of the daily average elevation data and relevant details regarding any deviations from the normal operating ranges are stored in digital format, and submitted to the FERC annually as the Cutler Annual Elevation Report, available for public review.

1.1.8 Summary of Project Implementation (Implementation Phase through 2012)

Implementation of each of these programs and program components is now complete (Table 1-1). The final component, development of one proposed primitive recreation site, was deferred until 2010 by FERC order (FERC 2005) but is now complete. Planting two new woody vegetation pockets to replace two failed and abandoned sites is also complete, as is the replacement and expansion of a previously monitored bank stabilization site. With one exception, all former property boundary issues noted in the 2002 five-year monitoring report are now resolved (note extensive new list, however), and a new Exhibit G was submitted to the FERC in 2008. Ongoing property trespass issues continue to be monitored and dealt with as they are identified, per the Cutler Monitoring Plan (PacifiCorp 2002). Two new recreation use programs (regarding motorized boat access zones on the reservoir and a seasonal trapping permit) are now in place. Note that Table 1-1 figures were updated from the previous five-year report to include new implementation activities conducted during the current monitoring period, 2008-2012. Monitoring points have been established for new sites (the two woody vegetation pockets, the new recreation site, and the new bank stabilization site) per the monitoring plan protocols; monitoring at all sites is generally continuing per the Cutler Monitoring Plan (2002) or as amended in the 2008 Cutler five-year report. One additional proposal to alter the original 2002 Monitoring Plan (PacifiCorp 2002) regarding fish habitat structure monitoring is made in this report.

1.2 RMP Monitoring Plan Summary

The RMP also required development of a monitoring plan for each of the implementation activities carried out at Cutler. The FERC license stipulated that monitoring results be reported at five-year intervals over the life of the license. Results of monitoring activities are used to gauge the success and stability of implementation, but also to help frame on-going O&M needs for the project that result in continual improvements. Monitoring protocols were established by adopting the seven implementation programs presented above in Section 1.1 as the basis for monitoring activities:

- Vegetation Enhancement Program
- Agricultural Lease Program
- Recreation Site Development Program
- Wetland Mitigation Program
- Fish Habitat Enhancement Program
- Water Quality Monitoring
- Water Level Monitoring

The monitoring plans consist of a description of the protocols, tasks, and schedule required for monitoring each of the programs and are detailed in Section 2.0 of the 2002 Cutler five-year report (PacifiCorp 2002). A summary and schedule of proposed monitoring activities for the Cutler project is shown in Table 1-3. Monitoring takes place annually or bi-annually with the exception of water quality monitoring, which is conducted quarterly, every fifth year. In addition, some aspects of fish habitat structure monitoring were deferred to major reservoir drawdown events, by agreement with UDWR. A major drawdown in 2008 and subsequent fish structure monitoring was not successful in locating the fish habitat structures; PacifiCorp is now proposing to suspend fish habitat structure monitoring until an agreeable alternative monitoring method can be identified. Another major drawdown is proposed for fall of 2013. Other fisheries monitoring activities (angler surveys) were deferred by agreement with UDWR until angler use increases to levels where adequate data can be collected.

Table 1-3. Monitoring Plan Components for Cutler Hydro Project No. 2420.

Task	Start Date	End Date
Vegetation Enhancement Program Monitoring		
Shoreline Buffer	May 1	July 31
Woody Vegetation	May 1	May 31
Bank Stabilization	June 1	June 30
Buffer/Boundary Fence	May 1	July 31
Erosion Control Sedimentation Basins	April 1	May 31
Sensitive/Unique Wildlife Habitat	April 1	May 31
Agricultural Lease Program Monitoring		
Grazing Leases	April 1	Nov. 30
Farming Leases	Year-round	
Wildlife Food/Cover Plots (spring)	May 1	May 31
Wildlife Food/Cover Plots (fall)	Eliminated as part of 2008 Cutler five-year report.	
Cattle Management Fence	May 1	July 31

Table 1-3. Monitoring Plan Components for Cutler Hydro Project No. 2420.		
Task	**Start Date**	**End Date**
Property Coordination	Year-round	
Recreation Site Program Monitoring		
Canoe Trail (ice off)	March 1	April 30
Canoe Trail (prior to freeze-over)	Oct. 1	Nov. 30
Boat-in Day Use Site (ice off)	March 1	April 30
Developed Day Use Site	March 1	Dec. 30
Developed Walking Trail (spring)	April 1	April 30
Developed Walking Trail (fall)	Nov. 1	Nov. 30
Primitive Recreation Site	March 1	Dec. 30
Wetland Mitigation Program Monitoring	March 1 through 2001, now complete.	April 30 through 2001, now complete.
Fish Habitat Structure Program Monitoring	Beginning in 2013, suspend until alternative monitoring is identified; continue to suspend angler use surveys until angler use increases to a point that adequate data can be collected.	
Water Quality Monitoring	Quarterly, every 5th year beginning in 2003; next data collection is taking place in 2013. Report in Cutler 5-yr reports.	
Water Level Monitoring	Compile average daily levels and file with FERC annually.	

Specific data sheets were designed as part of the 2002 Cutler five-year report (PacifiCorp 2002) and were utilized for most of the monitoring tasks. Hydro East staff files the completed data forms (currently both hard copy and electronic data), noting any required maintenance activities. Data are also tracked and filed digitally. This information is used as documentation for each of the five-year monitoring reports, and for future required reports over the length of the license.

1.3 2002 and 2008 RMP Monitoring Results Summary

A summary of the initial (2002) and most recent (2008) monitoring results is presented in Table 1-4, in order to facilitate comparison with the current period (2008-2012) monitoring results found in Section 2.0. Formal monitoring is currently underway for all implementation programs with the exception of the wetland mitigation program and the visitor use survey portion of the recreation site monitoring program, which are now considered complete. Fish habitat structure monitoring was previously deferred until major reservoir drawdown events, and is proposed to be suspended until agreeable alternative monitoring is identified (for details see Section 2.5). Past monitoring results are presented to summarize the previous (baseline, 2002; and most recent, 2008) monitoring period results regarding the requirements of the RMP and related FERC license orders, and to frame the comparison of current monitoring results and ongoing O&M activities.

Table 1-4. Initial (2002) and Most Recent (2008) Monitoring Results Summary for Cutler Hydro Project No. 2420.

Monitoring Program	Time Frame	Initial 2002 Results	2008 Results
Vegetation Enhancement Program			
Shoreline Buffer (54parcels)	Annual monitoring began in 2002	65% buffer parcels rated good to excellent; 0% fair; 35% rated poor to at-risk	60% buffer parcels rated good or excellent; 23% fair; 17% rated poor to at-risk.
Woody Vegetation Pockets (14 sites; 11 active, 3 failed/abandoned)	Annual monitoring began as sites were planted (1996-2001)	7 in good condition; 4 in marginal condition; 1 failed/abandoned	7 in established or good; 2 in marginal; 3 failed/abandoned 2 new sites proposed
Bank Stabilization (18 areas)	Annual monitoring began in 2002	81% in good condition 2% in fair condition 17% in poor condition	94% in good condition 6% in poor condition
Buffer/Boundary Fences (56 segments)	Annual monitoring began in summer 2002	15 problem areas identified; 8 due to continued farming of buffers taken out of production, 6 due to inadvertent farming damage.	10 problem areas identified (several chronic); several segments of fence or posts will need to be repaired or replaced during upcoming monitoring period
Erosion Control Sedimentation Basins (13 structures)	Annual monitoring began in summer 2002	12 functioning properly, although 1 is impaired; 1 inadvertently farmed over and destroyed. *Many now support wildlife during spring runoff and are currently being monitoring along with sensitive/unique wildlife habitat.*	All 13 functioning properly after maintenance. *Many now support wildlife during spring runoff and are currently being monitoring along with sensitive/unique wildlife habitat.*
Sensitive/Unique Wildlife Habitat Areas	Annual monitoring began in 2002	• Shorebirds and other wildlife appear to be increasing near erosion control sediment basins. • Great blue heron rookery used continuously.	• Similar use to 2002 report by shorebirds, herons, ibis, waterfowl, migratory songbirds, and cranes. • South osprey and both goose nesting platforms used starting in 2005.

Table 1-4. Initial (2002) and Most Recent (2008) Monitoring Results Summary for Cutler Hydro Project No. 2420.			
Monitoring Program	**Time Frame**	**Initial 2002 Results**	**2008 Results**
		• White-faced ibis colony used continuously. • Waterfowl, ring-necked pheasant, and Sandhill cranes appear to be benefiting from food/cover plots. • Shrub and willow plantings along RR Trail have experienced rapid and diverse growth and have attracted songbirds, wading birds, fish and moose. • No use of nest structures for osprey, goose, and burrowing owls noted yet (installed in 2001-02).	• Additional studies of water quality and the decline in macro-invertebrates in areas of the North Marsh near the historic white-faced ibis rookery are being considered by UDEQ; PacifiCorp will participate in the study and TMDL process.
Agricultural Lease Program			
Grazing Leases	Annual monitoring began in 2002	74% in good condition 26% in poor condition	Annual monitoring will continue as present. Additional qualitative data will be collected during next monitoring period to more closely correlate pasture health with grazing practices.
Farming Leases	Annual monitoring began in 2002	Areas of noncompliance have been reported to PacifiCorp's property agents. *Some noncompliance issues resolved but need continued monitoring. Five individuals farming PacifiCorp land without a lease have legal actions pending*.	Annual monitoring will continue as present. Additional buffer post markers will be installed as needed. *Some noncompliance issues resolved but need continued monitoring. Six*

Table 1-4. Initial (2002) and Most Recent (2008) Monitoring Results Summary for Cutler Hydro Project No. 2420.

Monitoring Program	Time Frame	Initial 2002 Results	2008 Results
			individuals farming PacifiCorp land without a lease have property or legal actions pending.
Wildlife Food/Cover Plots	Annual monitoring began in 2002	Late-season grazing has supplanted sharecropping on these lands, allowing breeding/nesting by waterfowl, pheasants, and cranes. Initial observations suggest increased goose production.	Managing up to 9 pastures for wildlife food/cover plots; replace semi-annual monitoring with annual spring monitoring only.
Cattle Management Fences	Annual monitoring began in 2003.	2002 monitoring indicated need for minor repairs.	Annual monitoring will continue as present; results indicate need for minor repairs annually.
Property Coordination	Annual monitoring began in 2002	Of 190 adjacent landowners, property incident monitoring forms are being used to track and document at least 20 (11%) current issues. Several areas being farmed without a lease are currently being addressed in court. New Exhibit G filed based on completing property surveys and trades.	Of 190 adjacent landowners, property incident monitoring forms are being used to track and document at least 11 (6%) current issues. Several areas being grazed/farmed without a lease are still being addressed through the legal system. On-going and chronic trespass issues will continue to be monitored and resolved through the property incident process.
Recreation Site Development Program			
Recreation Areas	Annual monitoring began in 2002	Overall, sites are in good condition with little need for major maintenance. • Buoys along North Marsh and Little Bear River Canoe Trail destroyed	Overall, sites are in good condition with little need for major maintenance. • Annual monitoring will continue • Development of last primitive rec

Table 1-4. Initial (2002) and Most Recent (2008) Monitoring Results Summary for Cutler Hydro Project No. 2420.			
Monitoring Program	**Time Frame**	**Initial 2002 Results**	**2008 Results**
		by ice or hunters will be replaced in fall 2002. • Noxious weeds noted near recreation site in South Marsh. • 4-wheeler use noted at Bear River Riparian Walking Trail.	site deferred until 2010, per FERC order • Canoe trail marker buoy system scheduled for replacement during the next monitoring period.
Visitor Use Survey	Complete	22% of respondents knew of Cutler Reservoir; 49% knew when location was explained—the majority of those felt that water quality was the biggest problem for recreation in Cutler Reservoir; 73% had never visited Cutler.	Actions complete in 2002.
Wetland Mitigation Program	Complete	Returned to landowner (UDWR) in 2001.	No future monitoring proposed.
Fish Habitat Structure Program	Began with installation (1996, 1998, 2000), completed per agency consultation and agreement.	Game fish present near structures in 1996. Few recorded in 1998. None in 2000. *Monitoring deferred until next major drawdown of the reservoir, per agreement with UDWR.*	Future annual monitoring proposed only during major reservoir drawdowns, per agency agreement. Agency notification and consultation recommended for early 2008, as next major drawdown is tentatively scheduled for fall 2008. Angler surveys deferred until angler use increases, by agreement with agencies.
Water Quality Monitoring Program	Quarterly, 1996-1998, (additional dates 2001-2003); now quarterly every five years: 2003, 2008…	Monitoring indicates that tributaries greatly influence water quality at Cutler. This influence appears to have masked the effects of water quality improvement measures such as erosion control and	Quarterly monitoring in 2003 (submitted as part of the 2008 Cutler five-year report) similarly indicated water quality concerns with the Cutler tributaries and inputs.

Table 1-4. Initial (2002) and Most Recent (2008) Monitoring Results Summary for Cutler Hydro Project No. 2420.			
Monitoring Program	**Time Frame**	**Initial 2002 Results**	**2008 Results**
		improved land use practices. The 2002 report contained information from the early monitoring periods; the 2008 Cutler report included the 2003 water quality monitoring data full report.	Monitoring will continue per the current quarterly, five-year intervals, as prescribed by the license. Next water quality data collection period is scheduled to occur in 2008 and will be expanded per recommendations of the 2003 data analysis and review.
Water Level Monitoring Program	Annual reports sent separately to the FERC since 2002.	Will be monitored separately, with average daily reservoir elevations compiled and reported to the FERC annually.	No change from previous; Cutler elevations generally stay comfortably within the tolerance ranges set by FERC order.

2.0 MONITORING PLAN RESULTS

This section of the report summarizes the monitoring results completed during the current monitoring period, 2008-2012. As previously described, monitoring results are presented to meet the requirements of the RMP and FERC license order, but also to help frame the O&M activities that will result in continual improvements for the project. Monitoring results also provide the framework for any necessary project modifications or proposed changes to the current monitoring plan, as specified in Section 3.0 of this report, the future plan and schedule. Most components of monitoring are working well to provide the information necessary to ensure continued success of the Resource Management Plan; any adjustments needed are detailed in Section 3.0.

A complete copy of the monitoring plan that guided the data collection and analysis presented here can be found in Section 2.0 of the 2002 Cutler five-year report (PacifiCorp 2002); initial monitoring results and monitoring plan requirements are also summarized in Section 1.0, Tables 1-1 and 1-3 of this report. As already noted, complete sets of monitoring results, data forms, and photos to date are available upon request from PacifiCorp Hydro Resources, Salt Lake City. The monitoring data results are summarized in the following sections due to the volume of complete data forms and photos involved (i.e., over 500 pages for Section 2.1.1, alone). Where appropriate, results from other documents (i.e., Cutler Operational Plan annual data or water quality monitoring data) are either referred to or appended.

2.1 Vegetation Enhancement Monitoring Program

The vegetation enhancement monitoring program 2008-2012 results are analyzed and presented for the following elements:

- Shoreline buffer monitoring
- Woody vegetation pocket monitoring
- Bank stabilization monitoring
- Buffer/boundary fence monitoring
- Erosion control sediment basin monitoring
- Sensitive/unique wildlife habitat area monitoring

2.1.1 Shoreline Buffer

The current five-year shoreline buffer monitoring period was completed in 2012. All 54 buffer parcels were traversed during each year to observe and categorize site conditions regarding plant community health, erosion, noxious weed presence, encroachments, and to take a photograph at each established, permanently-marked monitoring point. Table 2-1 summarizes the changes in overall condition of each buffer parcel from 2002 (baseline data for comparison) to 2012. Photos and the corresponding data forms from the permanent photo monitoring points illustrate the evaluation of excellent, good, fair, poor, and at-risk buffers, and are available upon request from PacifiCorp Hydro Resources, Salt Lake City.

Table 2-1. Cutler Reservoir buffer parcels by condition per year						
Conditions of Buffer*	**2002 (baseline)**	**2008**	**2009**	**2010**	**2011**	**2012**
Excellent	4	6	5	5	5	5
Good	26	27	31	29	30	35
Fair	0	11	9	12	13	8
Poor	16	5	8	6	4	4
At-Risk	6	4	1	2	2	2
***Excellent** = Established perennial vegetation with rare presence of noxious or annual plants and no erosion. **Good** = Increasing perennial vegetation with limited scattered noxious plants. **Fair** = Established perennial vegetation that is increasing but that has a minor encroachment or other issue that can be resolved in a single year. **Po**or = Limited perennial vegetation with increasing noxious or annual plants. In many cases condition is being aggravated by continued or recent farming or other encroachment. At-Risk = Annual vegetative cover offering little protection from surface erosion, or encroachment that threatens the existence or function of the buffer.						

As shown in Table B-1-1 (Appendix B-1), shoreline buffers exhibited a variety of buffer health conditions. Not surprisingly, those rated similarly shared some common attributes. The buffers rated in 'excellent' condition had established perennial vegetation and very few, if any, noxious weeds. They showed functionality in preventing erosion, filtering sediment and nutrients from adjacent land uses, and providing habitat for wildlife species. These parcels had no significant encroachment from adjacent land users.

In the buffers rated in 'good' condition, perennial plants were increasing in cover, and showing evidence of future adaptability to reproduce and continue their improvement in distribution. This trend was usually attributed to reclamation work done to increase perennial vegetative cover. These actions included control of encroachment from adjacent land use (refer to Section 1.1.2 and 2.2.5), management of invasive weeds, and seeding of perennial grasses and forbs as part of the buffer seed mix. Vegetative cover establishment was variable depending on soil type and precipitation amount and timing, but usually resulted in sufficient densities from two to three years post-treatment.

Buffers rated as 'fair' condition share several important features with those rated as 'good' such as increasing perennial vegetation and decreasing noxious, invasive, or unwanted species. What separates these two categories is the presence on those categorized as 'fair' of some issue that requires corrective action that can be addressed within a single season. For example, a buffer that would otherwise have been rated as 'good' would receive a 'fair' categorization if portions of the buffer had been inappropriately mowed by an adjacent owner, and through a single corrective action (letter and follow-up with the adjacent owner), the issue can be remedied. The key to this category is that the corrective action must be able to resolve the issue in a single year, and restore the buffer to functional 'good' condition. Other examples include buffers with machinery stored on them, or those with small controllable stands of noxious weed such as thistle.

Many of those rated 'poor' had no or very limited perennial vegetation that showed signs of stress. Furthermore, most of the vegetation that did exist in these buffers was dominated by noxious and/or annual weedy species. This category also had parcels that have been subject to recurrent encroachment.

Lastly, those buffers listed as in ‘at risk’ condition had very little perennial component and were dominated by annual, weedy vegetative cover. These parcels are prioritized for vegetative enhancement, but usually need to have issues with adjacent landowners resolved first, such as eliminating farming encroachment or procuring reclamation access.

Frequent wildlife observations were made on buffers that ranged from poor to excellent. Less evidence of wildlife utilization was found on buffers that were considered at-risk. In buffers where emergent wetlands comprised a portion of the buffer plant community, bank erosion was controlled. The presence of emergent wetlands along the shoreline was a greater indicator of bank stability than the presence of established perennial grass. In those buffers where bank erosion was active, monitoring results indicated there was not an immediate risk to adjacent landowners.

From 2008 to 2012, the general trend of the overall condition of the buffers has been improvement, with increases in the good and excellent categories, and decreases in the poor and at-risk categorized buffers. Years 2009 to 2011 included very wet springs, which contributed to increased growth of the shoreline buffer vegetation. On some parcels, buffer improvements can also be attributed to the increased enforcement against encroachment and management of noxious weeds. However, several buffer parcels are still being impacted by farming, grazing, and other encroachments. For the upcoming 2013 monitoring period, six buffer sites were identified as areas of high priority and in need of additional or ongoing remedial action (additional details can also be found in Sections 2.2.2 and 2.2.5 and Appendix D-4 of this document).

Church Farm: As noted in Section 1.1.1, the adjoiner to the Church Farm buffer has continued to remove and alter fences, graze the buffer, and deny court-awarded access for monitoring. Legal sanctions and additional precautions, including only going on site with a law enforcement escort, will continue to be utilized to address this chronic issue, although it is likely that these issues will persist as long as the current adjoiner remains there.

Lindley: This buffer area is in degraded condition from encroachment by adjacent landowner activity. This includes unauthorized access roads and cultivation. Remedial actions are pending resolution through the property incident process. This buffer currently has newly established roads that provide motorized access through the buffer to the shoreline; several buffer posts are also missing, which is surprising given the fact that PacifiCorp has already filed one lawsuit against the adjoiner for actions of this type, and believed the issue was resolved. In addition, there is currently a permanent duck hunting blind that has been constructed on the buffer. Several complaints have also been received from individuals who have attempted to access this area for hunting and have been told to leave by the adjacent landowner. Contact with the adjoiner and owner through a letter/ and or meeting will be made to discuss current recreation polices and a timetable for removal of the hunting blind and replacement of the missing buffer posts.

Griffin: The adjacent landowner has repeatedly trespass-farmed and destroyed buffer plantings. Further remedial actions are pending resolution through the property incident process. This buffer is currently being actively farmed, and is planted to the shore's edge. All buffer posts have been removed as well as photopoint markers. This has been a recurring problem, even after PacifiCorp understood it had an agreement with the adjoiner to respect the property ownership boundaries and the buffer was marked and reclaimed by seeding. Legal counsel may be required in order to strategize on appropriate solutions that can be undertaken. A letter/and or meeting will need to be set up with the adjacent landowner responsible for the trespass farming activities. PacifiCorp may also consider fencing as an option to permanently mark the property and reduce future trespass. The cost of such fencing, as well as additional, repeat reclamation efforts, will need to be determined.

G.B. Benson: This buffer is currently marked with buffer posts. The adjacent landowner has leased the farm ground and the lessee is farming several acres of the buffer. A meeting will be set up with the landowner and his current lessee to discuss the situation and to set up a timetable to reclaim the buffer.

Stewart/Ballard: The farm property adjacent to the various Stewart buffer segments is now owned by the former lessee, who has installed drain fields to help remove water from his crop lands. In doing so, areas of the buffers were dug up and disturbed without permission. In addition, the adjoiner illegally placed construction waste along the buffer shoreline on PacifiCorp land without permission in an attempt to provide bank stabilization. Contact with the adjoiner needs to be made to set up an on-site meeting to discuss options and reaffirm PacifiCorp policy of protecting its properties, and especially those where we have mitigation requirements.

Falslev Island: Several buffer posts have been removed or damaged by farm equipment. Each post will need to be located, which may require a survey for those that are missing, and replaced by a fencing contractor. A meeting with the adjoiner is necessary to discuss time frame and cost responsibility for post replacement (a repeat occurrence at this site).

These issues are summarized and others are further detailed in the property incident section (Section 2.2.5). PacifiCorp has established additional buffer monitoring points in this area to better monitor adjacent landowner activities.

Overall Findings: Future annual monitoring will continue as present, as this has proven to be a good mechanism for tracking the condition of this RMP component over time. Buffers rated as at-risk, poor, or fair were prioritized for corrective actions the following year. Currently, eight buffers are designated for corrective actions during the next monitoring period. Forty-six (85 percent) were rated as excellent to fair in 2012.

2.1.2 Woody Vegetation Pockets

The Cutler license and resultant RMP required at least ten 0.5- to 2.0-acre woody vegetation pockets be planted within the shoreline buffer. Currently, there are 11 existing woody vegetation pocket sites (Figure 1-1) (14 total have been planted since 1994, although three were determined to have failed and were abandoned during previous reporting periods), which were monitored continually throughout the current monitoring period. Baseline data were collected when the sites were planted, and data regarding survival of marked shrubs on transects were compiled as described for Phase I and/or Phase II monitoring in the 2002 Cutler five-year report. This monitoring period saw three years of wet spring weather, which contributed to increased growth at several of the vegetation sites.

At the end of the previous monitoring period two sites were labeled as failed/abandoned (Big Bend and Swift Slough). To replace these sites, two new woody vegetation pockets were planted, the Roundy Pump North and Roundy Pump South sites. Both sites were planted with Woods rose and golden current shrubs in the late fall of 2008. The initial baseline data from 2008 was lost, so 2009 shrub counts are were used to replicate the baseline data as all shrubs were marked in late 2008 when they were planted, thus the original data was retrievable. Both sites have experienced good results aided by the wet spring weather of 2009, 2010, and 2011.

Table 2-2 summarizes the results of monitoring to date on woody vegetation pockets.

Table 2-2. Summary of 2008-2012 Woody Vegetation Pocket Monitoring Results

Condition of Woody Veg Pocket	# Of Sites	Year Planted	Average % Survival Across Transects	% of Total Sites	Characteristics
Established G.B. South R.R. Trail Cutler Marsh Check Dam 7 Cowley Slough Rigby	6	 1999 1999 1998 1998 1998 1998	 84% (28%*) 53% (26%*) 45% (16%*) 58% (26%*) 56% (22%*) 82% (27%*)	55%	**'Established' shrub plots have >20% survival across transects and stable trend data.** These sites were deemed established in 2009 or 2010; next count in 2013 (Check Dam 7, Cutler Marsh Rec., GB South, RR Trail) or 2015 (Cowley Slough, Rigby).
Good Roundy Pump N Roundy Pump S	2	 2008 2008	 125% 77%	18%	**Shrub survival >=20% across transects but may not have stable survival trend data or is not >5 yrs since planting.** Move both to Established Phase II monitoring if 2013 results warrant.
Marginal Valley View	1	 1997/2001	 32% (13%*)	9%	**Shrub survival <20% across transects or decreasing survival trend data.** Continue to monitor using Phase I protocols.

Table 2-2. Summary of 2008-2012 Woody Vegetation Pocket Monitoring Results					
Condition of Woody Veg Pocket	**# Of Sites**	**Year Planted**	**Average % Survival Across Transects**	**% of Total Sites**	**Characteristics**
Poor 2600 N Lane Peterson	2	 1998 1999	0% transects 91% circle plots** 11% (8%*)	 18%	**Shrub survival <20% and decreasing survival trend data; consider augmentation or replacement after 2 or more years at this level.** Review both sites during 2013 monitoring for augmentation or replacement.
Failed/Abandoned **No longer counted** Larson Big Bend Swift Slough	3 (not included in total)	 1996 2001 1998/2001	n/a	n/a	**Original site considered failed and not re-planted.**
Totals	11			100	
*Note that percent survival across transect values does not include experimental species plantings that were initially unsuccessful; value includes only species that actually survived initially on site. **Plot value is skewed by a single species that is spreading in one small area; otherwise there are 0 shrubs that have survived at this site.					

Several vegetation pockets were moved to ‘established,’ over the current monitoring period and entered Phase II monitoring (see 2002 Cutler 5-year report for additional detail regarding the woody vegetation pocket monitoring). In 2009 Check Dam 7, Cowley Slough, and Rigby were all moved to the ‘established’ category, and all remained ‘established’ at the conclusion of the current monitoring period in 2012 (sites determined to be established are only counted every third year, rather than every year, although an annual site visit and monitoring photopoint continue). In 2010 the sites RR Trail, G.B. South, and Cutler Marsh were moved to the ‘established’ category as well. These sites will be recounted in 2013 to determine if they remain established, but all three sites looked good at the end of the current monitoring period.

The two newest woody vegetation pocket sites, Roundy Pump North and South, planted in late 2008, both had very good initial survival, and some transects even show evidence of suckering and good early production as plant counts on some transects are now higher than the baseline data values. Both of these plots appear to have good early shrub survival that continues to date; results of the 2012 monitoring indicate that these two sites will be proposed to move to the ‘established’ category in 2013, and subsequently Phase II monitoring.

Woody vegetation pocket Valley View remains in marginal/good condition. It suffered extensive rodent damage early in the monitoring period, but showed recovery towards the end of the monitoring period. This site will continue to be monitored using Phase I protocol. Vegetation pockets 2600 N Lane and Peterson have continued to decrease in productivity and shrub counts over this monitoring period. On the entire 2600 N site, only monitoring circle plot 2 has continued to improve, while all shrubs on all other transects have disappeared (Table 2-2). Although the combined average across transects and circle plots is still above the threshold value of 20%, and numerically still looks similar to some other good or established plots, the values are skewed by a single small site with a single species that is doing well, and needs to be re-evaluated. The Peterson site has continued to decline over this monitoring period, dropping from 17 percent at the end of the previous monitoring period to 11 percent survival across all transects at the end of the current period. Monitoring in 2013 will determine whether these sites require potential augmentation, or whether they have failed and need to be replaced.

Table 2-3 indicates the trend in condition for each of the plots; eight of the sites have shown improvement while two sites have trended as marginal. One site has continued to lose ground over the current monitoring period.

Table 2-3. Woody Vegetation Pocket Condition Trend.

Woody Vegetation Pocket ID	1998-2002	2003-2007	2008-2012	Trend since baseline
2600 N Lane	Marginal	Established	Poor	Degraded
Check Dam 7	Good	Established	Established	Improved
Cowley Slough	Good	Established	Established	Improved
Rigby	Good	Established	Established	Improved
RR Trail	Marginal	Established	Established	Improved
GB South	Marginal	Good	Established	Improved
Valley View	Good	Good	Marginal	Degraded
Cutler Marsh Rec	Good	Marginal	Established	Improved
Peterson	Good	Marginal	Poor	Degraded
Roundy Pump N	NA	NA	Good	Improved
Roundy Pump S	NA	NA	Good	Improved
Big Bend	Marginal	Failed/Abandoned	Failed/Abandoned	Failed/Abandoned
Swift Slough	Good	Failed/Abandoned	Failed/Abandoned	Failed/Abandoned
Larson	Failed/Abandoned	Failed/Abandoned	Failed/Abandoned	Failed/Abandoned

Overall Findings: Future annual monitoring will continue as present for both Phase I and Phase II sites, as this has proven to be a good mechanism for tracking the condition of this RMP component over time. The majority of the sites are improving or remain stable; Phase II monitoring will commence for the first time in 2013 for four sites, and will continue with the next count for two other sites in 2015. Future planning will be necessary to determine if new shrub sites need to be established due to the lack of improvement at the 2600 N Lane and Peterson sites.

2.1.3 Bank Stabilization

The Cutler license required 3.5 miles of bank stabilization, utilizing a combination of both ‘hard’ (using rock) and ‘soft’ (using vegetation) techniques. Virtually all sites now use a combination of both techniques, and covered a total of 23,356 feet or 4.42 miles at the beginning of the current reporting period (note that another 1.1 miles of bank stabilization was completed in order to construct the RR Loop Trail that is not counted in the 4.42 mile figure). The 16 (18 including the two that are part of the RR Loop Trail) bank stabilization parcels (Figure 1-1) were monitored during the current monitoring period using the protocol described in Section 2.0 of the 2002 Cutler five-year report (PacifiCorp 2002). A summary of the condition of each of the bank stabilization sites is presented in Table B-2-1, Appendix B-2. Photos and the corresponding data forms from the permanent photo monitoring points are retained in digital format and are available upon request from PacifiCorp Hydro Resources, Salt Lake City.

Table 2-4 summarizes the overall bank stabilization results gathered through monitoring efforts. Linear feet and miles are given by year and condition. This is done for all three (good, fair, poor) conditions for each year beginning with 2002 (baseline data year), and ending after 5 years of monitoring in 2012. Also included is the percentage of the total projects that is represented by each condition, each year.

Table 2-4. Summary of Results of Bank Stabilization Projects Monitored at Cutler Reservoir.

	2002 (baseline)		2008		2009		2010		2011		2012	
Condition	Feet/ Miles	% of Total	Feet/ Miles	% of Total	Feet/ Miles	% of Total	Feet/ Miles	% of Total	Feet/ Miles	% of Total	Feet/ Miles	% of Total
Good	16073/ 3.0	77.0	22178/ 4.2	94.7	22178/ 4.2	94.7	22178/ 4.2	94.7	22178/ 4.2	94.7	22178/ 4.2	94.7
Fair	0/0	0	0/ 0	0	0/ 0	0	0/ 0	0	1248/ 0.2	5.3	1248/ 0.2	5.3
Poor	4789/ 0.9	23.0	1248/ 0.2	5.3	1248/ 0.2	5.3	1248/ 0.2	5.3	0/ 0	0	0/ 0	0
Total	20862/ 3.9	100	23426/ 4.4	100	23426/ 4.4	100	23426/ 4.4	100	23426/ 4.4	100	23426/ 4.4	100

In 2012, all sites but one were rated as good condition. This strong majority of sites in good condition is due to overall increases in emergent and bank vegetation. At the end of the previous five-year reporting period in 2007, it was determined that all bank shrub plantings were in good condition and were increasing or stable, and therefore the bank shrub monitoring transects would no longer be counted (per the original bank shrub monitoring protocol). These areas are still part of the bank monitoring for the overall site assessment, and annual visual inspection and photopoint data indicate that all plantings remained as either increasing or stable. Although Check Dam 12 and RR Trail West sites remain in good condition, both are prioritized during the next monitoring period as sites of possible concern and increased inspection. Both sites are doing well overall, but small sections of each are experiencing some loss in bank and vegetation. Their overall condition remains ‘good’ but these smaller sections will be monitored closely to determine if any remedial action is required in the future.

The one exception to the overall ‘good’ condition of bank stabilization sites is the Stewart East site. In 2010, the lessee of the property adjoiner onsite, without notifying PacifiCorp, completed an unpermitted (and therefore illegal) re-stabilization of the site using demolition debris, an inappropriate material. Annual monitoring had already shown that large portions of this segment of bank stabilization had failed (it was originally constructed using a technique that has been discontinued and replaced at all other sites where it was used) and the site was scheduled for renovation/replacement. After lengthy and ultimately unsuccessful discussions with the adjoiner throughout 2011 regarding both acquisition of, and access to, enough buffer to re-stabilize the entire original bank segment, PacifiCorp slightly altered the footprint of the original Stewart East bank stabilization site by extending the site 70 feet to the east, increasing the total length of stabilized bank at the Cutler project to 23,426 feet, or 4.4 miles, to allow the bank stabilization/renovation to proceed.

In the fall of 2011, the illegally placed material was removed and extensive work was completed at the Stewart East site. Much of the original site was renovated (one small section of original concrete barrier remained in good condition and was not altered; another small section PacifiCorp could not access and was also not altered, although PacifiCorp did provide rock for the adjoiner to stabilize their section), and the site was extended 70 feet to the east in a repair/replace project. Similar to other successful bank stabilization efforts at Cutler (for additional detail, see also Sections 1.1.1 and 2.1.3 of the 2002 and 2008 Cutler five-year reports), the bank work was completed by first sloping the bank and placing large rock to form a breakwater zone approximately 1-2 feet out into the reservoir. Once a quiet water planting zone was established behind the rock, emergent marsh vegetation root wads were placed at intervals in the quietwater zone, and a trench was dug at the toe of the slope where willow bundles were placed horizontally; finally several thousand shrubs were planted on the newly sloped banks along the entire site. The disturbed upland was seeded with the same mix of perennial grasses used at other Cutler upland reclamation sites over the current monitoring period.

The original photopoint for Stewart East will still be used in future bank stabilization site monitoring, and two new photopoints have been established that will be used in monitoring the new bank stabilization (expanded area) at Stewart East. The new area will be monitored in addition to the original Stewart East site, but will be considered an extension of Stewart East and not a new site. At the end of one growing season post-construction, the site overall was in improving condition, although most of the banks were still bare as the shrubs had not yet grown and spread, the rock work was all intact and the emergent vegetation was starting to establish.

Overall Findings: As noted in the 2008 Cutler five-year report, the banks that were stabilized using the method of placing large rocks to create a breakwater zone yielded the greatest vegetative growth in terms of emergent wetland flora and bank shrubs, and therefore have the greatest long-term chance of success at bank stabilization. The sites where this method was employed seem to have fared the best, and this technique is now used exclusively for any needed repairs or replacement of previously stabilized banks. However, it is important to note that currently all sites are in good or improving condition and no specific future work is recommended for the bank stabilization component of the vegetation enhancement program at this time. The newly re-constructed Stewart East site will continue to be monitored, and we expect to see additional growth and spread of the emergent marsh vegetation established there, as well as of the new bank shrub slope plantings component, similar to other bank stabilization sites.

2.1.4 Buffer/Boundary Fence

The Cutler license and subsequent RMP required six miles of buffer and boundary fences be constructed, although to adequately protect and control the project boundaries, ultimately 60 miles of fence and posts were constructed (another six miles of cattle management fences were also required; see Section 1.1.1 and 2.1.4). The annual inspection of boundary/buffer fences and posts was conducted concurrently with the shoreline buffer monitoring in July and August during this monitoring period (see Table B-3-1, Appendix B-3 and Figure 1-2). Post and fence damage was documented to provide the basis for resolving problems that relate primarily to adjacent landowner or public encroachment. Most of the damage occurred from farm equipment as the adjacent land owners or lessees continued to farm too close to (or on) buffers that were previously taken out of production, most often by using farm equipment carelessly such that posts were broken off at ground level. This accounted for the majority of problems that were recorded from the 56 segments of boundary/buffer fences or posts, and generally consisted of one or more posts being removed. Post replacement was usually accompanied by a conversation and follow-up letter to the adjacent landowner or lessee indicating PacifiCorp intentions and reparation amounts, if any.

Chronic fence and post problems continue to persist at the Church Farm (Table B-3-1) and Lindley buffers (see also Section 2.1.1 and 2.2.5). Legal action against these trespassing and fence or post removal encroachments is continuing. Another area of chronic fence damage is on the south side of Highway 30 between the Valley View recreation site and the Logan River recreation site. This section of fence has received damage in many instances from cars losing control and running through the fence. In some reported cases (especially DUI incidents) the cost of replacement fencing is being sought.

As a result of buffer/boundary fence monitoring over the past five years, a running list of replacement/repair actions was developed to be completed during the annual upcoming fence maintenance. The completed boundary/buffer fence data forms have been changed to reflect management and documentation of performance and maintenance issues by exception. This information, documented by fence segment, is available upon request (PacifiCorp Hydro Resources, Salt Lake City). Photos of some incidents were also taken to document these occurrences and to assist in both property incident forms and any necessary follow-up legal actions.

Overall Findings: There are currently 60 miles of fence in this fence category. Future annual monitoring will continue as present, as this has proven to be a good mechanism for tracking the condition of this RMP component over time. During the fall of 2012 an extensive effort was made to perform all needed fence repairs, and as of 2012 all fences are in good working condition. Some areas where the boundary is marked with posts only still need attention during the next monitoring period. Areas prioritized for immediate action in 2013 include Lindley, G. Benson, H. Falslev Island, Roundy Middle, and Griffin. In these areas several, if not all, of the boundary posts have been removed. Areas may need to be resurveyed to ensure correct locations, PacifiCorp will need to determine what actions may needed to resolve these property boundary incidents (Table B-3-1, Appendix B-3).

2.1.5 Erosion Control Sedimentation Basins

The Cutler license and RMP required erosion control check dams and sediment basins where needed in the North Marsh and Reservoir Management Units. The 13 resultant erosion control sediment basins and corresponding check dams were monitored annually from 2008 to 2012. Conditions in 2007 showed all basins in good functioning condition prior to the current monitoring period. These conditions remained through the 2008 and 2009 monitoring periods. In 2010/2011 an above-average winter snowpack followed by a very wet spring caused all 13 basins to fill to capacity and remain full for several months. During this period, erosion control sediment basins 3, 7, and 11 sustained damage when water levels became so high that these dams overtopped their banks, causing partial washouts. Repairs were performed on all three basins during the fall of 2011. In 2012, sediment basin 3 overflowed again causing some additional erosion and road damage. Basin 3 was not constructed with an overflow, and future plans are in place to either install an overflow or to build up the checkdam to increase the amount of water that basin 3 can hold. Conditions of the remaining erosion control sediment basins remained the same in 2011 and 2012. Table 2-5 presents a summary of sediment basin conditions and remedial actions taken over the monitoring period.

Table 2-5. Summary of Results of Erosion Control Sediment Basins Monitored at Cutler Reservoir.

Sediment Basin ID#	2008	2009	2010	2011	2012
1	Good	Good	Good	Good	Good
2	Good	Good	Good	Good	Good
3	Good	Good	Poor (repairs needed)	Road way and dam repaired	Fair, consider redesign
4	Good	Good	Good	Good	Good
5	Good	Good	Good	Good	Good
6	Good	Good	Good	Good	Good
7	Good	Good	Fair (repairs needed)	Washout repaired	Good
8	Good	Good	Good	Good	Good
9	Good	Good	Good	Good	Good
10	Good	Good	Good	Good	Good
11	Good	Good	Fair (repairs needed)	Washout repaired	Good
12	Good	Good	Good	Good	Good
13	Good	Good	Good	Good	Good

Due to the high winter snowpack and following wet spring in 2010 and 2011, all 13 sediment dams retained water for several months, extending well after the normal spring runoff period. These conditions provided habitat for a variety of breeding amphibians, songbirds, waterfowl, and grebes. During winter and spring of years 2011 and 2012, below-average winter snowpack and runoff conditions were present, and wildlife and waterfowl were less prevalent due to the shortened time period where water was retained in the sediment dams. Sediment basin 11 continued to capture perennial water year-round, providing more sustained wildlife habitat.

All basins were inspected annually for T-post markers (marking the ends of the check dams), which were replaced if necessary. The completed erosion control sediment basin data forms illustrate the condition of the erosion control check dams, as well as detail the wildlife species utilizing these created habitats, and are available upon request (PacifiCorp Hydro Resources, Salt Lake City). Also note the related discussion in Section 2.1.6, as the habitats created by the sediment basins are also monitored as part of the sensitive/unique wildlife habitat program.

Overall Findings: Future annual monitoring will continue as present, as this has proven to be a good mechanism for tracking the condition of this RMP component over time. Erosion control sediment basins are in good condition throughout the North Marsh and Reservoir management units, with the exception of sediment basin 3, which is in fair condition. Basin 3 was not constructed with an overflow, and future plans are in place to either install an overflow or to build up the checkdam to increase the amount of water this can hold.

2.1.6 Sensitive/Unique Wildlife Habitat Areas

Areas within the Cutler project designated as containing sensitive or unique wildlife habitats are surveyed at least once annually (Figures 1-1 and 1-3). These sites include the spring in Cutler Canyon, the two osprey nest platforms near Benson Marina, the burrowing owl nest boxes, erosion control sedimentation basins, the ibis/gull/tern nesting colony located on islands in the North Marsh, and the six pastures around the Logan River (Logan River 1-3 and Spring Creek 1-3, serving as wildlife food/cover plots), as well as the great blue heron nesting colony located in the South Marsh. We believe that results from this monitoring will help track the effectiveness of the mitigation measures designed to improve and/or protect wildlife utilization of these sites.

In addition to PacifiCorp monitoring efforts, the Bridgerland Audubon Society also conducted monitoring for the ibis nesting colony located in Cutler’s North Marsh (Appendix C). White-faced ibis are listed as a globally imperiled species, and over five percent of the global population of white-faced ibis have been formally counted in surveys conducted over the current reporting period at the nesting colony in Cutler Marsh (counts in late June ranged from 1237 to 4230 birds during the years 2008-2012). In recognition of the importance of the habitat at Cutler Marsh for white-faced ibis and other bird species, in 2008 Cutler Marsh was designated by Birdlife International and the National Audubon Society as a Globally Important Bird Area (see additional detail in Appendix C).

Although the white-faced ibis colony was continuously inhabited during the nesting season over the current report period (note that in 2012, the colony was found to have moved slightly west to other, more isolated islands in the marsh), the colony size has changed in magnitude several times over past monitoring periods. These changes have occurred, possibly in conjunction with conditions in the Bear River Refuge, located on the west side of the Wellsville Mountains; i.e., during periods of favorable nesting conditions at the refuge, nesting ibis at Cutler may decrease, or decreases may be a response to disturbance or other environmental risk factors around the Cutler ibis colony. During the 2007 nesting season, the ibis, although initially present in lower numbers than previous years, eventually abandoned the nest colony completely, corresponding to lower numbers of ibis subsequently throughout the Cache Valley. It is currently unknown why the ibis abandoned the nest colony. Also in late 2007, the new Cutler motorized use policy was finalized by the state, which has resulted in a decrease in recreational disturbance to the colony area, and has allowed for enforcement of what had been a voluntary restriction in the past. As noted above, in 2008 and in the years since, the ibis returned and the nesting colony has been inhabited. Future monitoring will continue to assess this population of a rare species, which is a significant species of concern regarding management of the Cutler system. Loss of the ibis's macroinvertebrate prey base due to declining water quality (the ibis colony is located at the confluence of Swift Slough with Cutler Marsh; Swift Slough carries the effluent from Logan City's wastewater treatment facilities) is also being investigated as part of the development and implementation of the Cutler Total Maximum Daily Load (TMDL; see Appendix G for the water quality report and Appendix F for executive summaries of USU student papers on related topics). Regardless, the ibis colony continues to support habitat conditions important for a number of other waterfowl, shorebirds, and gulls, and with the exception of 2007, has been occupied continuously over the most recent (2003-2007) and the current (2008-2012) monitoring period.

One of the most interesting findings in other sensitive wildlife habitats has been a marked and sustained increase in long-billed curlew, American avocet, and black-necked stilt breeding pairs in the 300-acre parcel surrounding many of the erosion control basins in the North Marsh. This parcel was removed from agricultural production and converted to a perennial grassland prior to the 2008-2012 reporting period, and it has developed into a core upland habitat for breeding birds, large and small mammals, and high numbers of raptors. Although artificial nest burrows have been available for occupation by burrowing owls since 2002 in the same area, the target species has not been observed utilizing the sites. Short-eared owls regularly utilize the posts, and the burrows are being utilized by a variety of burrowing wildlife species. It is hoped that burrowing owls will eventually discover and utilize these sites.

The great blue heron rookery has been used continuously over the years monitored (Figure 1-1), primarily by great blue herons, but also by double-crested cormorants, and occasionally by Canada geese. Because seasonal fences now protect the area from cattle grazing, it now appears that recruitment of new cottonwoods and willows is occurring, as previous cattle grazing and shade-seeking was preventing widespread successful sprouting of future suitable replacement trees. Future monitoring will continue to prioritize and assess this factor.

Monitoring results indicate that common waterfowl (especially Canada geese and mallard ducks), ring-necked pheasants, and Sandhill cranes are the species that benefit most from the management of the wildlife food/cover plots located in the Logan River and Spring Creek pastures along the Logan River (Figure 1-3), although the proximity of high-quality riparian habitats along the Logan River has also resulted in habitat improvements for neo-tropical migrant songbirds. Late-season grazing has mostly supplanted grain sharecropping as management for the six fields around the Logan River, as well as occasionally for the 300-acre parcel on the west side of the reservoir and in Cutler Canyon.

The goose nesting platforms in the Watterson 100-acre parcel were constructed during 2002. They have been utilized since the 2004 nesting season. The osprey platforms were constructed and installed in late 2001; since 2006, the south nest platform has been utilized to fledge young osprey successfully during each of the current reporting period (2008-2012) years (Figure 1-1). Apparently water quality improvements in that portion of the reservoir have been sufficient to support osprey hunting, and ideally a second breeding pair will take up residence on the north platform also. Future monitoring reports will continue to indicate the nesting success observed for all artificial structures (two each for goose and osprey, four for burrowing owls).

The shrub and willow planting that occurred along the edges of the RR Trail (which replaced the requirement for planting roses in unsuitable habitat in the old Bear River Oxbow in the original RMP) is monitored annually to assess plant community vigor and wildlife utilization. Results of the monitoring indicate that the vegetation community establishment has been both extremely rapid and quite diverse. All three shrub species planted flowered their first year, and some of the willows have grown extremely prolifically (enumerated as '100' for 'continuous' in the data counts once there are >100 stems/m, linearly). A wide variety of neo-tropical migrant songbirds (especially goldfinches, warblers, kingbirds, and flycatchers), wading birds (great blue and black-crowned night herons), fish, and moose have been observed utilizing the willow habitat; none were observed prior to the planting project. Future five-year monitoring reports will continue to track and document habitat changes and subsequent wildlife utilization of these areas. The completed sensitive/unique wildlife habitat data forms detail the condition of special structures, habitats, and food and cover plots, as well as current wildlife utilization in those habitats. Completed data forms are logged, stored for the current five-year reporting period, and are available upon request.

Overall Findings: Future annual monitoring will continue as present, as this has proven to be a good mechanism for tracking the condition of this RMP component over time. Additional studies regarding Cutler water quality and the potentially related dearth of macroinvertebrates in the areas of the North Marsh surrounding the ibis colony may be conducted as part of the TMDL nutrient limit program currently being implemented by the state of Utah, or as part of the required five-year water quality monitoring conducted by PacifiCorp at Cutler (see also Section 2.6 and Appendix G). If conducted, these studies may give us more information about the previous abandonment of the white-faced ibis rookery in 2007, the shift in location that occurred in 2012, and potentially about other areas of sensitive or unique wildlife habitats.

2.2 Agricultural Lease Monitoring Program

The agricultural lease monitoring program results are analyzed and presented for the following elements:

- Grazing leases
- Farming leases
- Wildlife food/cover plots
- Cattle management fences
- Property coordination

2.2.1 Grazing Leases

Vegetative health is dependent on proportionate moisture required by the various flora species that occur within the 2,396 acres (of which 1,733 acres are part of the grazing program, and up to another 663 acres are part of the wildlife food/cover plots that may be grazed) of grazing lease pastures. The climate factors analyzed to describe pasture conditions during each of the five years of this monitoring period included average monthly temperature, average monthly precipitation, and monthly average evapotranspiration. Pasture conditions as related to climate factors are summarized below. Climate data were collected from the Utah Climate Center and are included here and in Appendix D-1 by calendar year, rather than water year data.

2008 - This year was the second driest, the coolest, and had the second-least moisture lost of the monitoring period years. The majority of the warm season precipitation came in May. The later-than-normal moisture allowed for less-than-average cool season grass-dominated pasture recovery. Warm season grasses recovered well due to the less-than-normal average monthly temperature, and higher-than-average precipitation.

2009 - This year was the second wettest year of the monitoring period; a high runoff season caused many pastures to be inundated with flood waters. This made many pastures inaccessible, and many plants not adapted to the anaerobic conditions caused by the flooding had difficulty recovering once the waters receded. The lower-than-average temperatures caused 2009 to be the second coolest of the monitoring years and resulted in the least water inches lost through evapotranspiration. Flora better adapted to the increased amounts water were invigorated; flora less adapted decreased.

2010 - In 2010, spring precipitation was significantly less than average and caused drought conditions to persist throughout the pastures. Some late-winter precipitation did provide enough moisture and a cooler spring than that of the previous monitoring years, allowing for a climate that was more advantageous for cool season grasses. However, late-winter precipitation and late-spring heavy precipitation caused invigorated growth through the pastures, as well as more flooding.

2011 - The most precipitation of the monitoring period years occurred during the months of April and May of 2011. This above-average precipitation, combined with the above average snowpack of December 2010 and early 2011, resulted in pastures being inundated with water for significant periods.

2012 – This year was the driest and hottest year of the monitoring period. Coupled with a wet spring, this resulted in invigorated noxious weed populations. Weed populations also matured earlier than normal, creating difficulties in the weed management program.

Monitoring conducted during the current monitoring period provided the opportunity to analyze areas where grazing management and wildlife habitat objectives were being met, and, as importantly, where they were not on the 1733 acres currently leased for grazing as part of the grazing program. The majority of the 39 grazing lease pastures monitored, 75 percent, were considered in good condition and meeting objectives at the end of the 2008-2012 reporting period. Several pastures are providing good quality lure crops for geese, waterfowl and Sandhill cranes (per the license and subsequent RMP, the primary target crop depredating species), and others are maintaining the vegetation community mix optimal for waterfowl and shorebird nesting and breeding habitat.

The monitoring also indicated that 25 percent of the pastures were considered to be in poor condition. Low condition ratings can be explained in pastures with persistent noxious weed issues and flooding issues (explained further in the North Marsh section, below). Pastures in this condition were still meeting wildlife habitat objectives, but producing less livestock forage.

As summarized in Table 2-6, vegetation measurements fluctuated according to several factors, including precipitation timing, fencing, and lessee performance. The Robel pole measurements quantify vegetation height and density. Corresponding data forms, including Robel pole forage utilization measurements from permanent photo monitoring points illustrate the evaluation of good, poor, and at-risk grazing pastures, and are available upon request (PacifiCorp Hydro Resources, Salt Lake City).

Table 2-6. Average Robel Pole Measurements by Season, 2008-2012

Year	Summer (Inches)	Fall (Inches)	Precipitation (Inches)	Pasture Condition*
2008	11.8	4.0	13.2	64/36
2009	13.7	4.9	17.2	81/19
2010	14.4	3.1	15.9	79/21
2011	14.8	4.8	18.5	80/20
2012	8.2	4.7	12.2	75/25

*percent total pastures in good/poor condition. Good = a rating of good or fair. Poor = rating of poor or at risk.

The following sections summarize conditions and management actions taken in each area of the grazing lease program during the current monitoring period (see Figures 2-1, 2-2, and 2-3).

Reservoir Unit

> **Lessee:** Watterson
> **Pastures:** East, West

The lessee on the Watterson grazing pastures (Figure 2-3) has been grazing livestock on PacifiCorp property for the entire 2018-2012 monitoring period (and for a very long time previously as well). Although he has followed the terms of his lease, management changes should be implemented to improve pasture conditions and reduce invasive species such as Russian olive.

North Marsh

> **Lessee:** Selman
> **Pastures:** NG1, NP1, NG2, NP2, NP3, NG3, NG4, NG5, NG6, NG7

In the North Marsh pastures (Figure 2-1), conditions deteriorated slightly. Much of this can be attributed to an increase of water flow from the Logan water treatment facility and corresponding water levels flooding several pastures and creating a vegetative community change.

Seven of the ten pastures also receive irrigation to generate vegetation growth. This irrigation is managed by the lessee. Growth performance of these pastures correlates to irrigation efficiency. Irrigation in this monitoring period has been consistent due to a better working relationship between PacifiCorp's lessee, the Logan Cow Pasture Canal Company, and Logan City.

Geese continued to extensively use the irrigated pastures as feed for goslings in the late spring and early summer. Grazing these pastures early helped to keep grass fresh for this wildlife use, as well as short, which was an attractant to geese by minimizing gosling predation in pastures with less hiding cover for predators.

Pastures without irrigation include NG2, NG4, and parts of NG3. They consist of alkaline soils that support little perennial grass growth. During the fall of 2005, and again in 2009, upland grass species, including intermediate wheatgrass, was planted on approximately 20 acres in NG2, NG3, NG4. These species have slowly been increasing in density and now compose approximately 45 percent of the ground cover. These pastures will continue to be grazed in the fall to allow existing vegetation to produce seed and then be incorporated into the soil.

In 2005 Logan City began dramatically increasing the volume in Swift Slough and Blue Springs through their use of this system as the route for return flows from their effluent polishing wetlands and water treatment facility. This action raised water in the canal and has eroded all access to NG6, as well as inundating most of the pasture and much of the surrounding lands. As a result, this pasture no longer provides much benefit to the North Marsh grazing program, and is under consideration for removal from the program. NP3 and NG1 have large portions of the pasture flooded for extended periods, which is resulting in a vegetation community change towards hardstem bulrush and cattail emergent wetlands. Grazing has proved to be ineffective at stopping the conversion in these areas given the continually increasing water volume discharged from Logan City, and persistence in the affected pastures.

South Marsh

Lessee: Kelly Walker
Pasture: SP2A, SP2B, SP2C, SG5A, SG5B, SG5C, SG5D, SG6A, SG6B, SG7

The series of pastures leased by Kelly Walker (Figure 2-2) was maintained in good condition over the past five years. Much of this condition can be attributed to adequate irrigation water in that all pastures can be flooded at least in part. PacifiCorp contractors ensure that canal structures are maintained; contractors and lessees ensure those fields are regularly watered.

All but two of these pastures are grazed in the fall to promote short, succulent feed for goslings and other waterfowl and shorebirds, and thus decrease goose and other species crop depredation on nearby agricultural lands. SP2A averaged a Robel pole measurement of 2.3 inches in the fall, and for the past five years hundreds of geese were observed using the pasture during May.

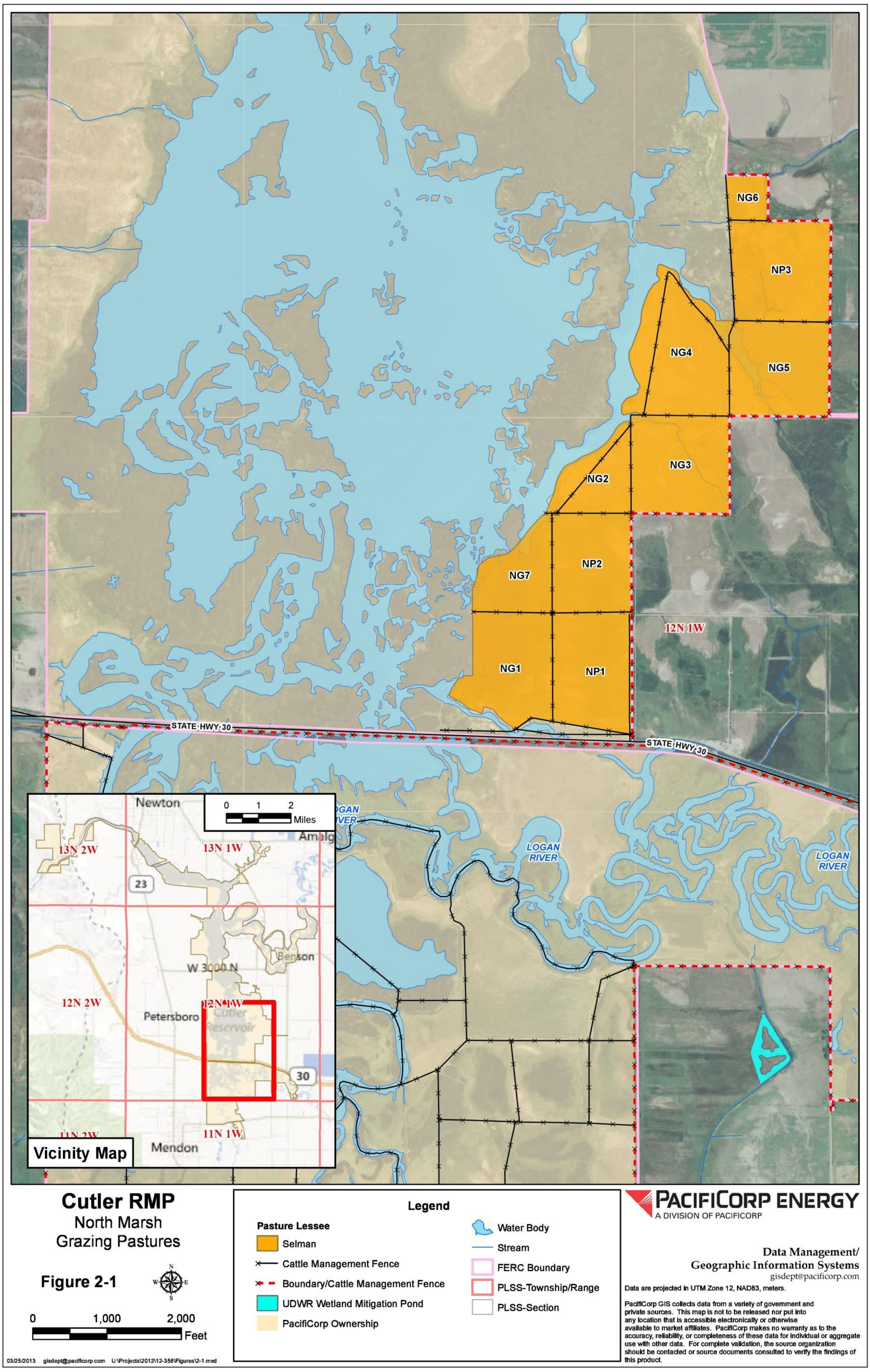
Annual maintenance in these pastures included harrowing to break down manure nutrient and create efficient vegetation growth. Ditch cleaning ensured the efficient use and movement of water in and through the pastures.

South Marsh

Lessee: Harry Wilmore

Pastures: SG1A, SG1B, SG2A

The pastures in this lease (Figure 2-2) have adequate production and maintain their condition in moderate to wet years. This helped to prevent over-utilization of the pastures, which was particularly important given the proximity of this leased area to the Cutler Marsh Marina, a point of congregation for many recreational marsh users.


NG6
NP3
NG4
NG5
NG3
NG2
NP2
NG7
12N 1W
NG1
NP1
STATE HWY 30
STATE HWY 30
LOGAN RIVER
LOGAN RIVER
Newton
0 1 2
Miles
Amalg
13N 2W
13N 1W
23
Benson
W 3000 N
12N 2W
Petersboro
12N 1W
Cutler Reservoir
30
11N 1W
Mendon
Vicinity Map
Cutler RMP
North Marsh
Grazing Pastures
Figure 2-1
0 1,000 2,000
Feet
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Legend
Pasture Lessee
Selman
Cattle Management Fence
Boundary/Cattle Management Fence
UDWR Wetland Mitigation Pond
PacifiCorp Ownership
Water Body
Stream
FERC Boundary
PLSS-Township/Range
PLSS-Section
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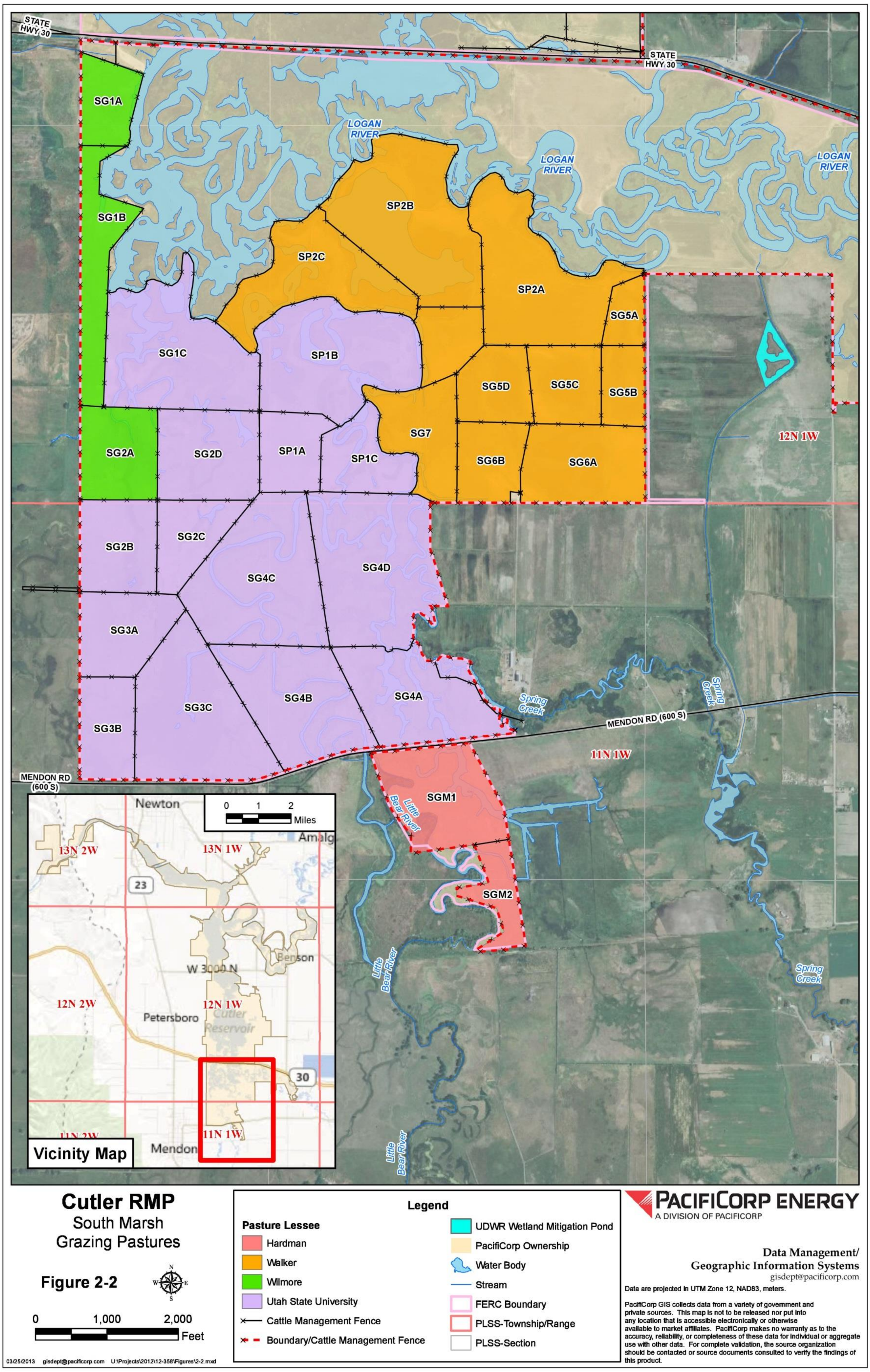

STATE HWY 30
SG1A
SG1B
SG1C
SG2A
SG2B
SG2C
SG2D
SG3A
SG3B
SG3C
SG4A
SG4B
SG4C
SG4D
SG5A
SG5B
SG5C
SG5D
SG6A
SG6B
SG7
SP1A
SP1B
SP1C
SP2A
SP2B
SP2C
SGM1
SGM2
LOGAN RIVER
Spring Creek
Little Bear River
MENDON RD (600 S)
12N 1W
11N 1W
Newton
13N 2W
13N 1W
12N 2W
12N 1W
11N 2W
W 3000 N
Petersboro
Cutler Reservoir
Benson
Mendon
Amalg
23
30
0 1 2 Miles
Vicinity Map
Cutler RMP
South Marsh
Grazing Pastures
Figure 2-2
0 1,000 2,000 Feet
Legend
Pasture Lessee
Hardman
Walker
Wilmore
Utah State University
Cattle Management Fence
Boundary/Cattle Management Fence
UDWR Wetland Mitigation Pond
PacifiCorp Ownership
Water Body
Stream
FERC Boundary
PLSS-Township/Range
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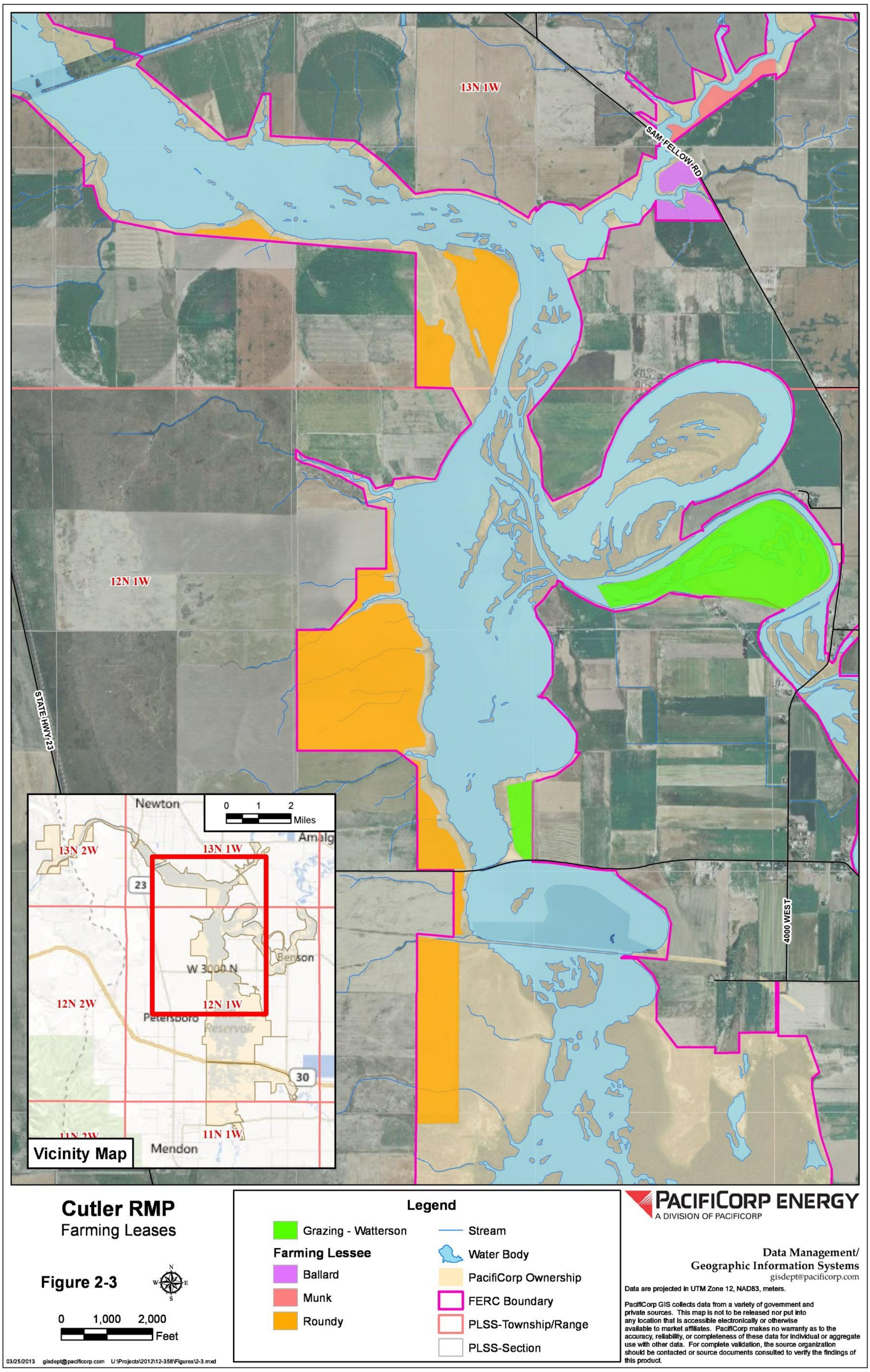
13N 1W
SAM FELLOW RD
12N 1W
STATE HWY 23
4000 WEST
Newton
0 1 2
Miles
Amalg
13N 2W
13N 1W
23
Benson
W 3000 N
12N 2W
12N 1W
Petersboro
Reservoir
30
11N 1W
Mendon
Vicinity Map
Cutler RMP
Farming Leases
Figure 2-3
0 1,000 2,000
Feet
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Legend
Grazing - Watterson
Farming Lessee
Ballard
Munk
Roundy
Stream
Water Body
PacifiCorp Ownership
FERC Boundary
PLSS-Township/Range
PLSS-Section
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gisdept@pacificorp.com
Data are projected in UTM Zone 12, NAD83, meters.
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South Marsh

Lessee: Utah State University

Pastures: SG1C, SG2B, SG2C, SG2D, SG3A, SG3B, SG3C, SG4A, SG4B, SG4C, SG4D, SP1A, SP1B, SP1C

The topography in this lease (Figure 2-2) is variable and moisture differences between marsh and upland can be difficult to manage, especially in coordination with weed management and pasture reclamation efforts.

The topography also presents a challenge in fencing. Areas that have six feet of water one year may only have six inches the next; several water features (Figure 1-2) are utilized as pasture dividers that may or may not be effective given the water year. Electric fences are often modified to keep cattle in the designated pasture and to eliminate their ability to use multiple pastures at a time. This requires more frequent monitoring by the lessee, which has continually been a challenge during this monitoring period. The lessee is continuing to improve their performance in monitoring their cattle to ensure an effective rotational grazing program.

Willow and cottonwood regeneration in SG4A and SG4B (in the vicinity of the great blue heron rookery, but not the specific area around the base of the existing rookery trees, has increased due to shifting the grazing schedule for these pastures into the late fall. These changes are significant in providing a diversity of age classes in woody habitat structure.

South Marsh

Lessee: Heber Hardman

Pastures: SGM1, SGM2

The overall health of these two pastures was very good (Figure 2-2) and they were well maintained over the past five years. The positive working relationship with the Hardmans proved effective in that they maintained a healthy and growing riparian area along the old Little Bear River floodplain. In an area where the property boundaries are complex, having this effective working relationship with the adjoiner (we have exchanged mutual long-term leases in areas that would be extremely difficult or even impossible to fence the actual property boundaries) has been particularly valuable.

Overall Findings: Although the health of the majority of the 1,733 acres of grazing lease program pastures overall was rated as good (averaging 76 percent of the pastures of the current five-year monitoring period), adjacent noxious weed issues and neighboring land uses necessitate continued monitoring and preventative measures. These include agreements with neighbors on weed management and rights-of-way use and access issues. Up to another 663 acres may be grazed as part of the wildlife food/cover program; see also Section 2.2.3.

2.2.2 Farming Leases

Farming leases (Figure 2-3) on all 445 acres have continued to improve through application of guidelines and conditions outlined in the RMP. Monitoring and auditing by PacifiCorp's property agents has helped to identify non-compliance and improve compliance with lease conditions. Instances of non-compliance have been documented through the incident tracking protocol described in the Cutler Monitoring Plan (PacifiCorp 2002). Also see Section 2.2.5 for additional detail regarding lease compliance and monitoring information tracking in coordination with PacifiCorp's Property Management.

To reduce discrepancies in rent owed at the end of the year, in 1999 property agents implemented a "flat-fee" approach rather than the crop-share farming lease used in the past. This change has been successful in more clearly stating expectations and making the year-end lease accounting process less subjective.

All farming lease areas were formally monitored for compliance with the RMP and lease conditions annually during the current monitoring period. All non-compliance was either documented by or reported to the assigned property agent for documentation according to the property incident tracking protocol. Some non-compliance issues have been resolved but will continue to need monitoring. Currently, at least six individuals are farming or occupying PacifiCorp lands without a lease within the Cutler project boundaries and have actions pending property incident outcomes (see also Section 2.1.1 for additional details) In another case, a lessee illegally filled a wetland that PacifiCorp had to excavate and subsequently charged the lessee the contractor's cost; in addition to incurring the cost of the damages, additional lease language was added, giving specific remedies and stronger language for termination of the agreement through default. Documentation of farming lease monitoring is available upon request from PacifiCorp Property Management, Salt Lake City.

Overall Findings: Future annual monitoring will continue as present, as this has proven to be a good mechanism for tracking the condition of this RMP component over time. Encroachments will continue to be managed through establishing leases, documented requests, or civil action. Actions are determined by evaluating resource needs and potential impacts of continued disturbance. With Griffin, G.B Benson, Munk, Cardon, Lindley, and Falslev, PacifiCorp needs to address each situation through follow-up meetings and agreements where possible, and legal action if necessary, to address the missing post/trespass issues.

2.2.3 Wildlife Food/Cover Plots

As noted in Section 2.1.6, tightly monitored occasional late-season grazing has supplanted sharecropping for most of the wildlife food/cover plots, covering up to 663 acres (Figure 1-3). The results of monitoring in the pastures managed as part of this program indicate that late-season grazing allows for breeding/nesting utilization of these pastures by waterfowl, pheasants, shorebirds, and Sandhill cranes (the target species for this enhancement), that later grazing can often successfully convert tall grass pastures to the desired shorter habitats for spring wildlife utilization, and that grazing is superior to sharecropping by requiring less invasive and intensive land manipulation, and by eliminating bare ground that is subject to sheet flow and other erosive forces. The completed wildlife food/cover plot data (as a result of the monitoring timing and use, sensitive/unique wildlife habitat data forms were utilized for this assessment) illustrate the evaluation of good and poor condition food and cover habitats, as well as detail current wildlife utilization in those pastures. Of the nine wildlife food/cover plot pastures currently being monitored (Logan River Pastures 1,2,3, Spring Creek Pastures 1,2,3, Cutler Canyon, Gull Pt., and the 300-acre parcel), eight were in 'good' condition and one (Logan River 2) was in 'fair' condition. See also Section 2.1.6 for additional detail and results related to this monitoring component. Completed data forms are available upon request from PacifiCorp Hydro Resources, Salt Lake City.

Overall Findings: Future annual monitoring will continue as present, as this has proven to be a good mechanism for tracking the condition of this RMP component over time. Wildlife food/cover plots are overall in good shape throughout the project; as a result, annual spring monitoring only will continue to be utilized rather than the spring and fall monitoring originally suggested in the 2002 Cutler Monitoring Plan (change proposed as part of the Cutler 2008 report).

2.2.4 Cattle Management Fences

The Cutler license and resultant RMP required 6 miles of cattle management fencing (separate from that described previously for buffer/boundary fences); approximately 21 miles of fence in this category were built to meet the objectives and spirit of the license. Functioning cattle management fences are integral to the success of the overall grazing lease program at Cutler, as grazing is one of the primary tools utilized to create and maintain much of the wildlife habitat available on the project, and appropriate grazing is central to providing habitat 'lure' areas that minimize impacts of wildlife depredation on surrounding agricultural producers (Figures 2-1 and 2-2). All cattle management fences (as differentiated from buffer/bounding fences, Figure 1-2; see also Sections 1.1.1 and 1.1.2 of this report; also PacifiCorp 2002) are monitored at least twice a year as prescribed in the Cutler RMP Monitoring Plan, Section 2.2.4 (PacifiCorp 2002). Although not specified in the lease agreement, all lessees are required to check the condition of fences prior to moving cattle into a new pasture. Pastures that contain electric fences require lessees to monitor cattle multiple times per week. The documentation of cattle management fences has been changed to manage and document performance and maintenance issues by exception. This information is available upon request from PacifiCorp Hydro Resources, Salt Lake City.

Annual maintenance included tightening gates and braces when necessary. Electric fences were strung and tightened every spring before the grazing season (never earlier than June 1 to allow safe hatching of ground-nesting waterfowl and shorebirds, although occasionally later based on the precipitation and other variables of a given year). At this time fencing contractors also installed, tested, and replaced as necessary solar chargers and batteries, to ensure adequate fence power. Vegetation commonly grew into the fence during each growing season, reducing its capacity and, therefore, its effectiveness. Contractors mowed electric fence lines as needed to ensure their integrity. Following the end of the grazing season, the fences were let down before ice formation, and the batteries were stored.

Table D-3 (Appendix D) describes the maintenance performed on grazing pasture fences and their condition during the current monitoring period, 2008 to 2012.

Overall Findings: Future annual monitoring will continue as present, as this has proven to be a good mechanism for tracking the condition of this RMP component over time. No changes to the cattle management fence monitoring protocol are suggested.

2.2.5 Property Coordination

Property coordination monitoring efforts included annual lease review and auditing, documenting and tracking property incidents, and coordinating appropriate responses and resolution of trespass and other property incidents. As stated in Section 2.2.2, at least six areas have been identified as being farmed without a lease, or are otherwise in a chronic trespass condition. Other non-agricultural-related property incidents included the repeat trespass on and destruction of a buffer by a state agency utilizing it for a staging area. This issue was resolved by the agency eventually paying the reclamation costs on the buffer. Several of the more severe and/or chronic (e.g., Church Farm) on-going property issues are currently being addressed through PacifiCorp's legal department. Other incidents continue to be addressed and monitored with the cooperation of property agents and the adjacent landowners per the monitoring plan and PacifiCorp's existing property incident protocol (Section 2.2.5, PacifiCorp 2002), a process which documents and resolves non-compliance issues on project lands. Current buffer issues are in the process of being resolved on 10 buffers including the six detailed previously. Of the approximately 190 adjacent landowners and lessees within the Cutler project boundaries, property incident monitoring forms are being used to track and document 10 current issues regarding property management or coordination (approximately 5 percent). Appendix D-4 contains a summary table of the property incident forms documented during the current monitoring period. Documentation of property coordination monitoring is archived as both hard copy and electronically, and is available upon request from PacifiCorp Property Management, Salt Lake City.

Overall Findings: Future annual monitoring will continue as present, as this has proven to be a good mechanism for tracking the condition of this RMP component over time. One additional task, entering property coordination into the compliance management system (CMS) was a part of the property coordination monitoring protocol in the Cutler Monitoring Plan (2002) to ensure continuity of relatively long-term and often complex tasks; this measure has been adapted to instead document property incidents as part of the Hydro East license compliance tracking spreadsheet which is reviewed and updated bi-monthly, at a minimum.

2.3 Recreation Site Monitoring Program

In general the recreation sites were in good condition during the current monitoring period. The 15 Cutler recreation sites (three canoe trails, two hiking trails, two boat-in sites, four developed sites, and four primitive sites) (Figure 1-4) were monitored throughout the current monitoring period, 2008-2012, to assess the status of their condition using procedures described in Section 2.0 of the 2002 monitoring report (PacifiCorp 2002). All of the sites exhibited good conditions in general and required minor maintenance as documented by the monitoring.

Use of the recreation sites has increased greatly over the past 5 years, based on FERC Form 80 data (Appendix E-5). This is due in part to the population increase in Cache Valley, and in part to the prevalence of alternative recreation locations being fee-based for activities such as hunting and boating, as well as the opportunities Cutler presents for convenient access for recreation, including hiking, birding, fishing, and canoeing. The highest use times occur during the waterfowl and pheasant hunting seasons, followed by the spring season. It is not uncommon for parking lots to be at or over capacity, particularly in the early days of a new hunting season. FERC Form 80 documentation, which quantitatively tracks recreation site visitation and use, is required on a six-year cycle and will be collected and compiled next in 2014 for submission in 2015. The most recent FERC Form 80 data was completed in 2008 and submitted to FERC in 2009. Those data showed seasonal visitor user days during sampling periods ranging from 2535 to 12,440, for a total of 87,450 annual visitor user days and 1,010 peak weekend user days at Cutler recreation sites (Appendix E-5). Note that large visitor numbers suggest that the visitor use survey conducted in 2001 is now dated (73 percent of respondents then had not been to Cutler Reservoir).

The sites are also being increasingly used by organized groups such as local universities and primary or secondary schools for science classes studying the characteristics of wetland or aquatic ecosystems and water quality, and for university research projects. Additional special uses of Cutler over the past five-year period have included: annual AKC dog trial competitions, annual carp bow hunt competitions, MS Bike-a-thon aid stations, multiple Eagle Scout and other service projects, a running race series, and similar events. In order to accommodate these increasing special requests (both commercial and not-for-profit) to use portions of the Cutler project area, PacifiCorp has created a Temporary Special Use Permit application form that ensures permittees and their participants are aware of any relevant special requirements or resource constraints, and that they have the appropriate insurance and risk management coverage to minimize company liability on PacifiCorp property. A list of these Temporary Special Use permits granted during the current license period is included in Appendix E-6.

In addition to ongoing PacifiCorp weekly (spring-fall) recreation site maintenance, during the last three years the Utah Mud Motor Association and the Utah Bowhunter Association (UMMA/UBA) have organized a Cutler Marsh litter and debris cleanup activity, consisting of up to 100 volunteers staging out of Benson Marina. In order to maintain aesthetic sites, the Cutler Hydroelectric plant personnel also complete weekly

The new Logan River recreation site, constructed in 2010 and opened in early 2011, allows safe canoe access along Highway 30 between Logan City and Cutler Marsh Marina, and includes a UDOT-approved parking pullout.

seasonal maintenance of the facilities, including mowing and restroom maintenance. This maintenance presence has minimized vandalism over the current period.

As noted above in Section 1.1.3, the new Logan River recreation site was constructed in 2010—as required by the original license and subsequent orders that laid out an agreed-upon alternative schedule of initial implementation—and opened in early 2011 (Figure 1-4). The new recreation site allows safe canoe access along Highway 30 between Logan City and Cutler Marsh Marina, and includes a UDOT-approved parking pullout, replacing the former, hazardous highway-edge parking that some recreationists used to access the Logan River in this reach. A small boat dock, parking lot, and gravel path to the water's edge have been installed at this location. Several trees, permanent signs and fences, and a concrete pad for a portable restroom were also installed at the new Logan River recreation site.

Other recreation site improvements include more gravel being placed at all major parking areas, and bare ground herbicide treatment applied to parking areas. Damaged signs have been repaired and new signs installed where applicable. New signs identifying each

Typical recreation facility sign board

recreation site throughout the reservoir have been added to existing sign boards; the contents of all boards, including maps, FERC Form 80 information, and new regulations concerning motorized usage in various areas of the reservoir are standard throughout the area.

Concerns noted through monitoring included the continuing presence of a number of noxious weeds near the recreation sites, and continued all-terrain vehicle (ATV) use at the Bear River riparian walking trail, despite site modifications including boulders and berms intended to preclude this motorized use. These concerns will continue to be monitored and new strategies will be devised to address these issues as they occur.

The condition of the recreation sites and any maintenance that occurred were recorded digitally and on hard copy, and are available upon request from PacifiCorp Hydro Resources, Salt Lake City. On an annual basis the following was completed at most sites:

- Placement of boat docks in and out of the water as well as any maintenance needed to provide for safe use.
- General cleanup and removal of trash and decadent vegetation.

- Cleaning of permanent restrooms and placement of portable facilities in some sites.
- Cleaning, painting and replacement, when necessary, of informational and FERC Part 8 signs.
- Replacement or repair of damaged gates, fences, and safety reflectors.
- Grading of parking surfaces as necessary and when conditions permitted.

A list summarizing significant maintenance completed by project per year can be found in Appendix E-1.

Due to the floating buoys along the canoe trails being consistently shot and/or destroyed by winter ice, the original buoys marking the three canoe trails have been replaced by metal posts with reflectors. This method has proved durable and effective.

Overall Findings: Future annual monitoring will continue as present, as this has proven to be a good mechanism for tracking the condition of this RMP component over time. The Logan River recreation site was opened for use in early 2011, and is now being monitored with the other recreation sites. No other changes to the recreation site monitoring protocol are suggested. FERC Form 80 monitoring will proceed as scheduled, with data collection and analysis occurring next in 2014.

2.4 Wetland Mitigation Monitoring Program

As noted previously, this monitoring program was completed with the submission of the final monitoring report and site visit in 2001. Future five-year monitoring reports will not detail this monitoring program element, as once the final monitoring report was accepted by the COE and the site was officially transferred back to the UDWR, all future O&M, and any further monitoring are the responsibility of the UDWR as the landowner.

Overall Findings: No future monitoring is proposed as this RMP component is now complete.

2.5 Fish Habitat Enhancement Monitoring Program

Previous monitoring of the fish habitat structures began shortly after they were installed in 1995. Cooperative electrofishing monitoring activities with UDWR recorded a few game fish in the vicinity of the structures in 1996. The species found in close proximity to the habitat structures included black bullhead, largemouth bass, black crappie, green sunfish, and bluegill. However, in 1998 similar monitoring activities resulted in few game fish and in 2000 high numbers of carp and no game fish were recorded (Table 3-4, PacifiCorp 2002).

Note that the earlier electrofishing monitoring efforts produced very few fish per effort undertaken. Conclusions from the aquatic biologists involved were that game fish habitat, species diversity, and population numbers would likely continue to be limited by poor water quality and low numbers of forage fish. No additional monitoring of the structures or the fish around them was undertaken or required (based on 1996 agreements with UDWR, discussed below) during the 2003-2007 report period.

However, since the most recent PacifiCorp/UDWR joint electrofishing effort in 2000, the state contracted with Utah State University to assess the overall fishery health in Cutler Reservoir, as part of the current TMDL Assessment prepared for Cutler Reservoir (SWCA 2010). Their study, conducted in 2005 and 2006, showed relatively greater diversity and fish numbers than expected, based on previous monitoring and observations (Budy et al. 2006). Also note that additional and more recent fishery monitoring efforts by USU aquatic ecology professors and students reflect greater diversity than believed, but also describe a very eutrophic and potentially deteriorating system due to human impacts on water quality and ecology at Cutler. Summaries of the fisheries and limnology data are included in Appendix F (Budy unpublished data, 2009-2012; and Wurtsbaugh unpublished data 2007-2010).

As noted in Section 1.1.5, the other two original Fish Habitat Structure Monitoring Plan elements (angler use/creel surveys and visual inspections of the structures) were changed per agreement with UDWR (1996 letters attached to the 2002 Cutler report). It was suggested that the habitat structures could become impaired due to sediment, and that inspections take place only during major drawdown events, such as occurred during the late fall of 2008, as underwater visibility is extremely poor in the reservoir. Results of relevant monitoring conducted as planned during that drawdown are included below. Per the 1996 agreement letters, and based on follow-up discussions with UDWR regarding comments on the draft 2013 five-year report, PacifiCorp proposes to continue to defer the angler use surveys until angler use or management issues or questions are sufficient to warrant the surveys (as determined by UDWR; see also additional details in Section 1.1.5). If there is interest in exploring the issue further, PacifiCorp, UDWR, and USFWS can meet to discuss in 2013.

As noted previously in Section 1.1.5, a major planned reservoir drawdown took place in the late fall of 2008, from November 4-16. Per the 2002 Monitoring Plan, monitoring of the fish habitat structures was one of the planned elements of the drawdown. At the dam the water level fell to an estimated elevation of 4,385 feet (normal pool is 4,407.0 feet at the dam), while at Benson Marina the lowest level recorded was 4404.32 feet (note that a large sediment deposition area at the confluence of the Bear River and Cutler Reservoir prevents uniform elevations during drawdown events and creates a 'slope' on the reservoir during drawdowns; also see Appendix H for more annual reservoir water level data).

Visual inspection of the structures by PacifiCorp and UDWR staff was attempted during the drawdown; however, the structures could not be located. Searches were made by boat, utilizing a long pole to probe the reservoir bed in and around the vicinity where the structures were originally placed. PacifiCorp and UDWR staff discussed the matter at the time and hypothesized that either the structures were buried in sediment, or periodic high currents at the locations they were originally placed (in relatively deeper water in the vicinity of the Benson Marina Bridge and the old Benson railroad bridge, now the

Tires cabled together in the shallow water surrounding Benson Marina, put in place by UDWR for fish habitat. Photo taken during major reservoir drawdown in 2008.

pedestrian access fishing bridge) had altered their locations thus rendering them lost for the purposes of monitoring their condition (Schaugaard, pers. comm. 2008). PacifiCorp staff did locate several masses of tires, cabled together, in the shallow water surrounding Benson Marina, that after consultation with UDWR, were determined to be fish habitat structures likely placed by UDWR staff (see photo).

As another major drawdown is currently proposed to occur in the fall of 2013, PacifiCorp preliminarily and informally discussed with UDWR the need for, and utility of, this monitoring, before proposing it be suspended as part of the draft version of this report. Although relatively easy to undertake, with water elevations slightly higher than they were during the previous 2008 major drawdown, it seemed unlikely that we would be able to locate the fish habitat structures at this time, especially as another five years has gone by. PacifiCorp is proposing to suspend this monitoring activity at this time, until a suitable alternative monitoring technique is identified. UDWR staff support this proposal (see Appendix I, UDWR comment letter).

Overall Findings: Future monitoring of fish habitat structures during major drawdowns is proposed to be suspended as it is currently not effective. Future monitoring will occur, per agency and PacifiCorp agreement, when a suitable alternative monitoring technique is identified. Per agreement with UDWR, angler surveys have been deferred until angler use increases to a point where adequate data can be collected. As a large magnitude drawdown is tentatively scheduled for fall of 2013, agency notification and consultation will continue through the 2013 drawdown event.

2.6 Water Quality Enhancement Monitoring Program

Water quality monitoring results for the current monitoring period include the samples taken quarterly in 2008, per the Cutler license. The next water quality sampling period will commence in 20013, again, quarterly per the license. Quarterly sampling will be conducted every 5th year (i.e., 2013, 2018, 2023) through the end of the license; analysis and results will be included in future monitoring reports. The information in this section is a summary and synthesis of the 2008 water quality monitoring; Appendix G includes the full results of the 2008 monitoring and subsequent analysis report.

The water quality monitoring dataset collected by PacifiCorp around Cutler Reservoir covers a wide range of tributaries and reservoir locations and a variety of physical and chemical water quality constituents. Sample locations included Little Bear River, Spring Creek, Logan River, Bear River, Cutler Reservoir at Benson Marina, Cutler Reservoir east of Highway 23, Cutler Reservoir south of Swift Slough, and Bear River below Cutler Dam (see Figure 1, Appendix G). Chemical parameters include nutrient concentrations of phosphorus (total and orthophosphate), nitrogen as NO_3, NO_2, and NH_3, and physical parameters include temperature, total suspended solids, and dissolved oxygen (DO) values. The samples were collected quarterly during three monitoring periods (1996–1998, 2000–2003, and 2006–2008). These three monitoring periods are characterized by varied hydrologic conditions, based on water discharged from Cutler Reservoir to the Bear River during these time periods. The monitoring period between 1996 and 1998 was characterized by wet conditions and high flows, while 2000–2003 was characterized by dry conditions with low flows. The most recent hydrologic period, from 2006–2008, is characterized by moderate flows, with 2008 being the driest of these three moderate flow years. Future samples will be collected quarterly at five-year intervals throughout the remainder of the license (starting in 2013 and continuing until 2024),

Differences in water quality parameters between the three monitoring periods are most likely related to the marked difference in hydrologic conditions. Data collected between 2000 and 2003 generally indicate increased temperature, reduced coliform bacteria, reduced turbidity, and increased concentrations of phosphorus throughout the Cutler Reservoir system compared to the earlier and later monitoring periods. Only small differences in pH, inorganic nitrogen, and DO were noted between the three monitoring periods.

Water quality varied by season and hydroperiod for most parameters analyzed across monitoring periods; however this variation appears to be site-specific, with different patterns emerging in the Bear River and Cutler Reservoir system compared to the southern tributaries. Turbidity is generally highest during the spring season while nutrient concentrations at some sites, including Cutler Reservoir, are generally highest in the summer season.

Data collected over the various monitoring periods between 1996 and 2008 indicate that water quality in the southern tributaries, specifically Spring Creek and the Little Bear River, and Swift Slough have dramatic impacts on water quality throughout Cutler Reservoir. Spring Creek continues to have significantly higher tributary nutrient concentrations as compared to the other sampling locations within the watershed. Water quality in the southern (south of Benson Marina) and northern (north of Benson Marina) sections of the reservoir remains markedly different with the south being characterized by higher nutrient concentrations, higher turbidity, and lower DO. High nutrient loads to the southern reservoir are partly from point source discharges in Spring Creek (JBS Swift and Company) and Swift Slough (Logan City and Service Area Wastewater Treatment discharge). Due to slow-moving water and the shallow nature of the southern reservoir (1.8 feet mean depth), reservoir sediments are likely to exert a greater influence on water quality there than in the faster-flowing and deeper northern reservoir (3.6 feet mean depth).

Monitoring results also determined that due to the significant influence of tributary water quality parameters, the performance of potential water quality improvements such as implementation of erosion control features and improvements in land use practices was masked. Further basinwide efforts to address land uses that may degrade water quality will likely need to be implemented in order to result in overall water quality improvements to Cutler Reservoir.

Because a variety of other agencies, non-governmental organizations, the City of Logan, private companies, and other stakeholders (primarily municipal, agricultural and animal processing interests) focused initially in the monitoring period on development, and subsequently on the implementation of a TMDL for the Bear River upstream to the state line and Cutler Reservoir proper, greater efforts through collaboration and cooperation should result in increased, measurable benefits to water quality. Future five-year monitoring reports will continue to track and document water quality parameters, and resultant improvements.

Overall Findings: Future annual monitoring will continue per the current quarterly, five-year intervals as prescribed by the license, as this has proven to be a good mechanism for tracking the condition of this RMP component over time. The next water quality data collection period is scheduled to occur in 2013, and will be expanded to cover two new collection sites and several new collection times, including during run-off and storm events, per the recommendations of the 2003 data analysis and review. Further, Logan City now has a compliance schedule to meet new TMDL limit targets of no later than 2017, which, along with other TMDL plan implementation, should start to reduce the high nutrient loading of Cutler Reservoir.

2.7 Water Level Monitoring Program (Cutler Operational Plan)

Because this monitoring element is covered under a separate modified order with a different reporting timeline (see Appendix H of the 2002 Cutler five-year monitoring report), it was determined that the annual summary of results of water level monitoring would be submitted to FERC independently of this report. Average daily reservoir elevations are compiled, analyzed, and reported to FERC by December 31 of each year (summary graphs are included in Appendix H). The full reports are available upon request from PacifiCorp Hydro Resources, Salt Lake City.

Overall Findings: Future annual monitoring will continue as present, as this has proven to be a good mechanism for tracking the condition of this RMP component over time. No changes to the Cutler reservoir level monitoring program, or the Cutler operating plan, are suggested; data will continue to be filed annually with the FERC and summarized graphically in this series of five-year reports.

3.0 MONITORING PLAN AND SCHEDULE FOR NEXT FIVE-YEAR RMP IMPLEMENTATION PERIOD

The RMP required monitoring to gauge success and stability of the seven implementation programs described in the first Cutler five-year report (2002):

- Vegetation Enhancement
- Agricultural Lease
- Recreation Site Development
- Wetland Mitigation
- Fish Habitat Enhancement
- Water Quality Monitoring
- Water Level Monitoring

In addition, monitoring results are used to identify O&M needs and aid continual program improvement. Table 3-1 summarizes 1) routine monitoring activities and schedules defined in the 2002 Cutler five-year report and as modified in the 2008 report, 2) modifications to routine monitoring that will occur during the next five-year RMP implementation period (2013-2017), and 3) additional license compliance needs identified during the current five-year RMP implementation period (2008-2013).

Monitoring typically occurs either annually or biannually. An exception, water quality monitoring, is conducted quarterly every fifth year. Monitoring of fish habitat structures, by 1996 letter agreement with UDWR, was to occur only during major reservoir drawdowns. However, future monitoring of fish habitat structures is proposed to be suspended as it is currently not effective. Similarly, in 1996 UDWR also agreed to wait to conduct angler use (creel) surveys until sufficient anglers/fisheries management issues/questions are present to warrant the activity.

Detailed monitoring protocols, tasks, and schedules are provided in Section 1.2 of the 2002 report, and are summarized in Table 1-2 of this report. Unless specified in Table 3-1, monitoring during 2013-2017 will follow protocols established in the 2002 Cutler five-year report.

Table 3-1. Monitoring Plan and Schedule for Cutler Hydro Project (FERC No. 2420), 2013-2017.			
Task Name	**Task Description**	**Task Frequency**	**Task Duration**
Vegetation Enhancement Program Monitoring			
Shoreline Buffer	1. Continue routine monitoring according to Section 2.1.1, in PacifiCorp 2002.	Annual	May 1-Jul 31
	2. Initiate routine monitoring of the new W. Larson buffer.	May 1-Jul 31 2013	
	3. Resolve discrepancies between the number of currently monitored buffer parcels (i.e., 54 and the number of buffers in the GIS database (57 will likely be tracked starting in 2013).	May 1-Jul 31 2013	
	4. Continue to address concerns at chronic buffer encroachment areas (Church Farm, Lindley, etc.), based on annual monitoring findings.	Ongoing	
Woody Vegetation	1. Continue routine Phase I monitoring at 'good', 'marginal', and 'poor' woody vegetation pockets according to Section 2.1.2 in PacifiCorp 2002.	Annual	May 1-May 31
	2. Initiate routine Phase II monitoring at 'established' woody vegetation pockets Roundy North and Roundy South if 2013 monitoring results warrant; continue at previously 'established' sites (see Section 2.1.2, PacifiCorp 2002).	Annual	May 1-May 31
	3. Evaluate need for augmentation or replacement sites at Peterson and 2600 North woody vegetation pockets.	May 1-May 31 2013	
	4. Initiate budget and requisition process for any augmented/ replacement woody vegetation pockets, as required.	2013	
	5. Procure planting materials for any required augmentation/ replacement woody vegetation pockets	2014-2015	
	6. Plant the augmented/replacement woody vegetation pockets.	2014-2015	
	7. Initiate routine Phase I monitoring at any new woody vegetation pockets, as required (see Section 2.1.2, PacifiCorp 2002).	2014-2015	
Bank Stabilization	1. Continue routine monitoring according to Section 2.1.3 in PacifiCorp 2002; ensure new Stewart East bank is included.	Annual	Jun 1-Jun 30
Buffer/Boundary Fence	1. Continue routine monitoring and maintenance according to Section 2.1.4 in PacifiCorp 2002.	Annual	May 1-Jul 31

Table 3-1. Monitoring Plan and Schedule for Cutler Hydro Project (FERC No. 2420), 2013-2017.			
Task Name	**Task Description**	**Task Frequency**	**Task Duration**
	2. Install replacement buffer/boundary fences/posts at problem buffer/boundary areas.	Ongoing	
	3. Scope and delineate property boundary on south side Cutler Canyon parcels.	Summer 2013-2015	
	4. Resolve discrepancies between the number of currently monitored buffer/boundary fences and the number in the GIS database.	Winter 20013	
Erosion Control Sedimentation Basins	1. Continue routine monitoring according to Section 2.1.5 in PacifiCorp 2002.	Annual	Apr 1-May 31
Sensitive/Unique Wildlife Habitat	1. Continue routine monitoring and maintenance according to Section 2.1.6 in PacifiCorp 2002.	Annual	Apr 1-May 31
All Vegetation Enhancement Program components	1. Address database correction/completion/discrepancy issues for all components.	2013-2014	
Agricultural Lease Program Monitoring			
Grazing Leases	1. Continue routine monitoring according to Section 2.2.1 in PacifiCorp 2002; add individual pasture assessment on good/fair, poor/at-risk measurement scale annually.	Annual	Apr 1-Nov 30
	2. Annually collect and document grazing AUM data from lessees.	Annual	Dec 1- Dec 31
Farming Leases	1. Continue routine monitoring according to Section 2.2.2 in PacifiCorp 2002.	Annual	Jan 1-Dec 31
	2. Install additional boundary posts/carsonite markers at chronic trespass sites as needed to prevent encroachment.	Ongoing	
Wildlife Food/Cover Plots (spring)	1. Continue routine according to Section 2.2.3 in PacifiCorp 2002.	Annual** [**Changed from twice/year, to once, spring-only in 2008.]	May 1- June 30
Cattle Management Fence	1. Continue routine monitoring according to Section 2.2.4 in PacifiCorp 2002.	Annual	May 1-Jul 31
Property Coordination	1. Continue routine and on-going property coordination tasks according to Section 2.2.5 in PacifiCorp 2002.	Annual	Jan 1-Dec 31

Table 3-1. Monitoring Plan and Schedule for Cutler Hydro Project (FERC No. 2420), 2013-2017.			
Task Name	**Task Description**	**Task Frequency**	**Task Duration**
	2. Enter Property Management tasks into the Hydro License Compliance spreadsheet** to ensure continuity of relatively long-term and complex tasks. [**Proposed in this report to change from using the CMS software to track, pending approval.]	Ongoing	
Recreation Site Program Monitoring			
Recreation Areas	1. Continue routine monitoring of the canoe trails at ice-off according to Section 2.3.1 in PacifiCorp 2002.	Annual	Mar 1-Apr 30
	2. Continue routine monitoring of the canoe trails prior to freeze over according to Section 2.3.1 in PacifiCorp 2002.	Annual	Oct 1-Nov 30
	3. Replace trail markers at the three canoe trails as needed.	Annual	Apr 1-Jul 30
	4. Continue routine monitoring of the Boat-in Day Use Sites at ice-off according to Section 2.3.1 in PacifiCorp 2002.	Annual	Mar 1-Apr 30
	5. Continue routine monitoring of Developed and Primitive Day Use Sites according to Section 2.3.1 in PacifiCorp 2002.	Annual	Mar 1-Apr 30
	6. Continue routine spring monitoring of Developed Walking Trails according to Section 2.3.1in PacifiCorp 2002.	Annual	Apr 1-Apr 30
	7. Continue routine fall monitoring of Developed Walking Trails according to Section 2.3.1in PacifiCorp 2002.	Annual	Nov 1-Nov 30
Wetland Mitigation Program Monitoring: Program is complete and no more monitoring will occur.			
Fish Habitat Structure Program Monitoring			
Fish Habitat Structures	1. Consult with UDEQ, UDWR, USFWS, and FERC for a potential fall 2013 reservoir drawdown.	2013	Feb 1-Aug 31
	2. Suspend monitoring plan element to monitor fish habitat structures during potential large magnitude reservoir drawdowns** [**Change proposed in this report.]	2013 Pending agency concurrence	
	3. Continue to defer angler use surveys, per agreement with UDWR; meet with USFWS and UDWR if necessary to discuss further.	2013	Jun 1-Nov 30

Table 3-1. Monitoring Plan and Schedule for Cutler Hydro Project (FERC No. 2420), 2013-2017.			
Task Name	**Task Description**	**Task Frequency**	**Task Duration**
	4. In cooperation with UDEQ, consider potential LIDAR mapping of reservoir during next schedule reservoir drawdown of sufficient magnitude.	Opportunistically	
Water Quality Monitoring			
Quarterly Monitoring	1. Monitor water quality quarterly during 2013. Next quarterly monitoring due 2018 (sampling in 2018, data analyzed and report written in 2019 and included in 2023 Cutler five-year report). • Utilize two new sampling sites (Northern Reservoir Segment and the Southern Reservoir Segment's North Marsh Unit) to address water quality concerns in Cutler Reservoir as identified in the current TMDL process. • Monitor water quality according to the quarterly sampling period, which adds one new sampling period during high spring runoff at all locations and a new storm-event monitoring period at all locations per the 2003 water quality summary report, Appendix G Water Quality.	5-year interval; data collected quarterly	Feb 1, 2013-Feb 1, 2014
	2. Ensure water quality sampling monitoring contracts/budget are in place in previous year	Jan 2017 and 2022	
Implementation of Cutler Total Maximum Daily Load (TMDL) limits.	1. Participate in and track Cutler TMDL implementation.	quarterly meetings, as scheduled	2004-completion
Water Level Monitoring			
Reservoir Operations Plan	1. Monitor and compile average daily reservoir elevations.	Annual	Oct 1-Sep 30
	2. Prepare annual reservoir operation report and file with FERC.	Annual	Dec 1-Dec 31

4.0 REFERENCES

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APPENDIX A

COMPARISON MAPS

COMPARISON MAPS

This series of comparison maps—the original conceptual drawings ("A" series) paired with the 'as built' versions ("B" series)—have been updated for this five-year report. They are intended for side-by-side comparison.

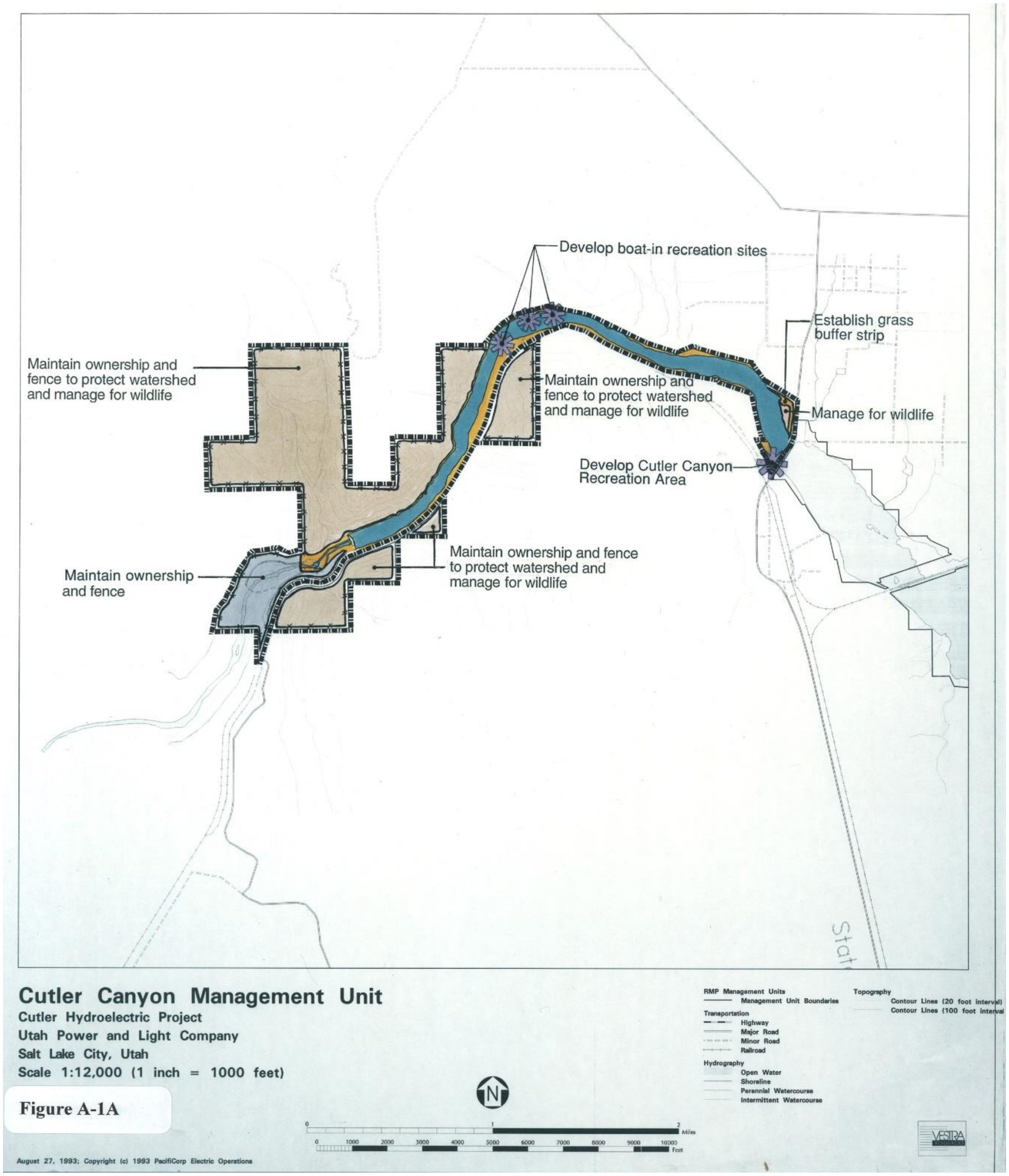

Develop boat-in recreation sites
Establish grass buffer strip
Maintain ownership and fence to protect watershed and manage for wildlife
Maintain ownership and fence to protect watershed and manage for wildlife
Manage for wildlife
Develop Cutler Canyon Recreation Area
Maintain ownership and fence to protect watershed and manage for wildlife
Maintain ownership and fence
Stat
Cutler Canyon Management Unit
Cutler Hydroelectric Project
Utah Power and Light Company
Salt Lake City, Utah
Scale 1:12,000 (1 inch = 1000 feet)
RMP Management Units
Management Unit Boundaries
Transportation
Highway
Major Road
Minor Road
Railroad
Hydrography
Open Water
Shoreline
Perennial Watercourse
Intermittent Watercourse
Topography
Contour Lines (20 foot interval)
Contour Lines (100 foot interval
N
0 1 2 Miles
0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000 Feet
August 27, 1993; Copyright (c) 1993 PacifiCorp Electric Operations

Figure A-1A

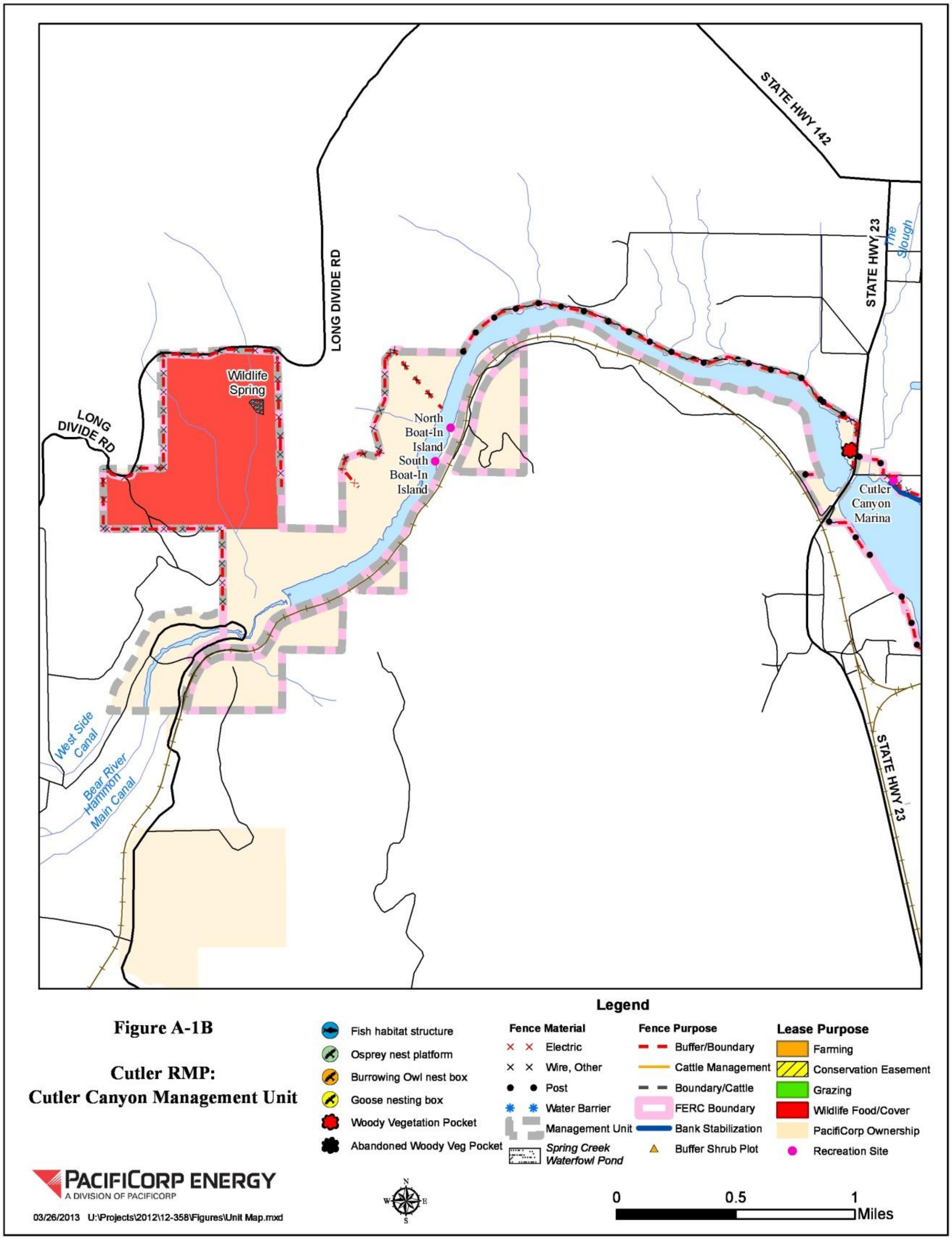
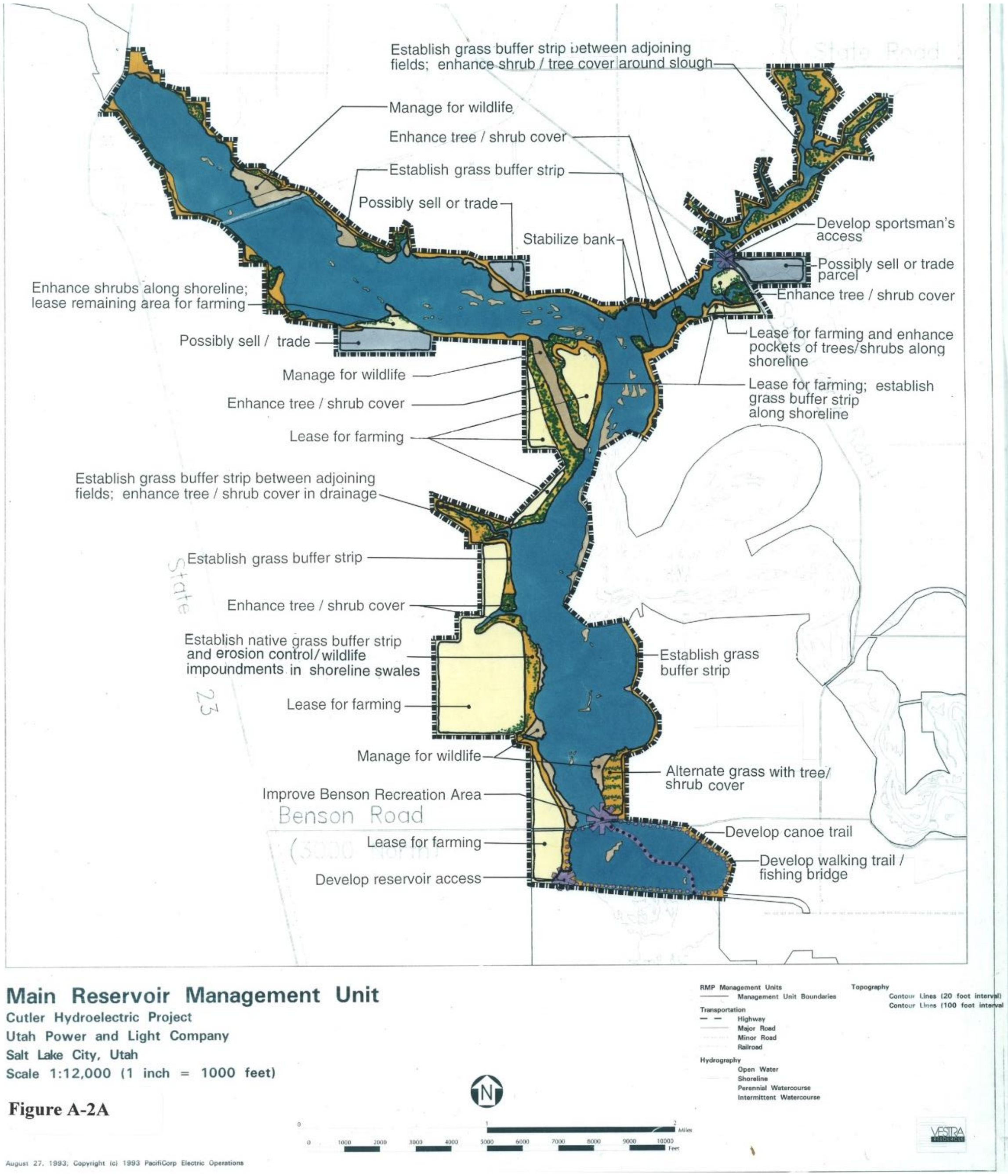


Figure A-1B

Cutler RMP:
Cutler Canyon Management Unit



Establish grass buffer strip between adjoining fields; enhance shrub / tree cover around slough
State Road
Manage for wildlife
Enhance tree / shrub cover
Establish grass buffer strip
Possibly sell or trade
Stabilize bank
Develop sportsman's access
Possibly sell or trade parcel
Enhance tree / shrub cover
Enhance shrubs along shoreline; lease remaining area for farming
Possibly sell / trade
Lease for farming and enhance pockets of trees/shrubs along shoreline
Manage for wildlife
Enhance tree / shrub cover
Lease for farming; establish grass buffer strip along shoreline
Lease for farming
Establish grass buffer strip between adjoining fields; enhance tree / shrub cover in drainage
Establish grass buffer strip
State
Enhance tree / shrub cover
Establish native grass buffer strip and erosion control/ wildlife impoundments in shoreline swales
Establish grass buffer strip
23
Lease for farming
Manage for wildlife
Alternate grass with tree/ shrub cover
Improve Benson Recreation Area
Benson Road
Develop canoe trail
Lease for farming
Develop walking trail / fishing bridge
Develop reservoir access
Main Reservoir Management Unit
Cutler Hydroelectric Project
Utah Power and Light Company
Salt Lake City, Utah
Scale 1:12,000 (1 inch = 1000 feet)
RMP Management Units
Management Unit Boundaries
Transportation
Highway
Major Road
Minor Road
Railroad
Hydrography
Open Water
Shoreline
Perennial Watercourse
Intermittent Watercourse
Topography
Contour Lines (20 foot interval)
Contour Lines (100 foot interval)
N
Miles
Feet
August 27, 1993; Copyright (c) 1993 PacifiCorp Electric Operations

Figure A-2A

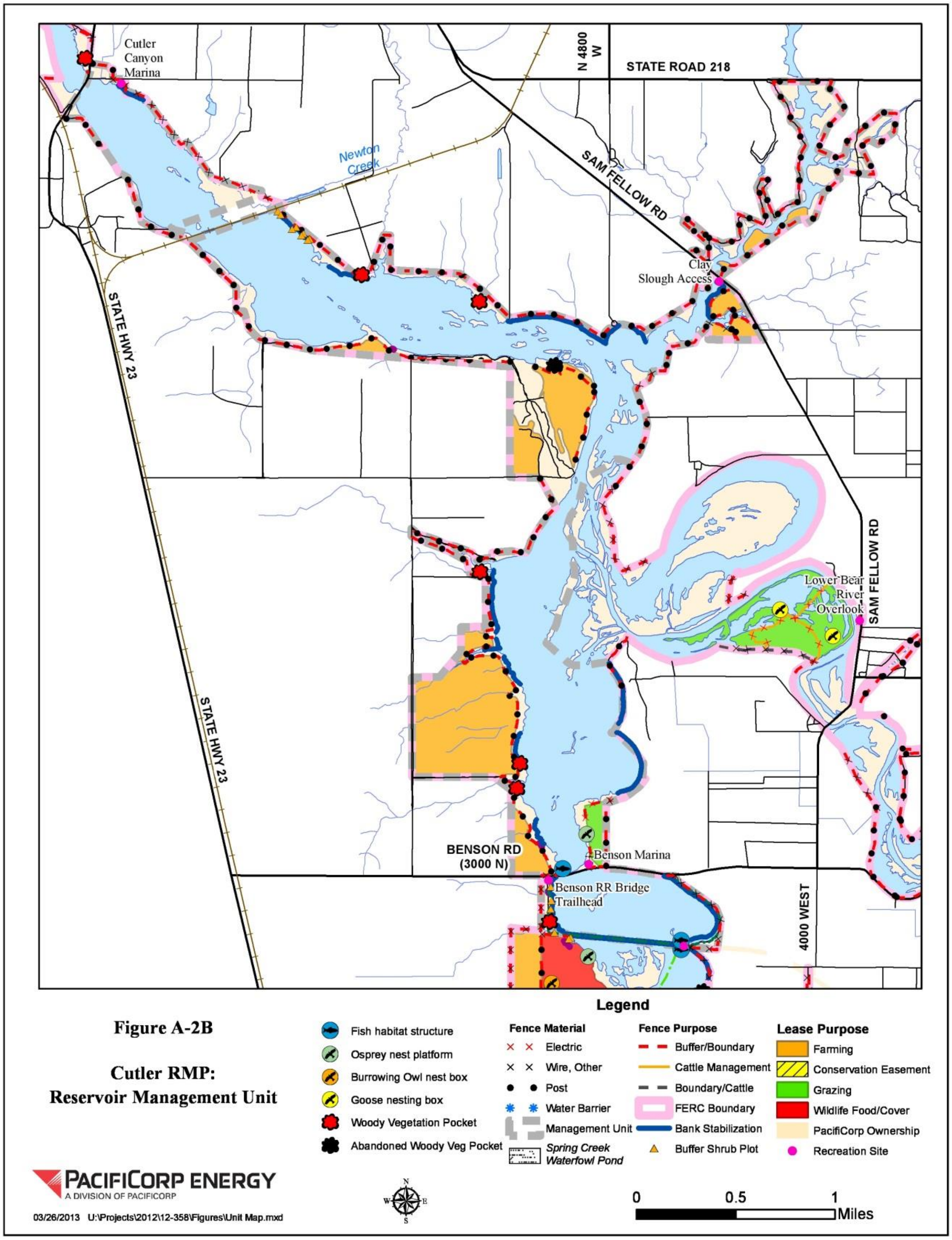
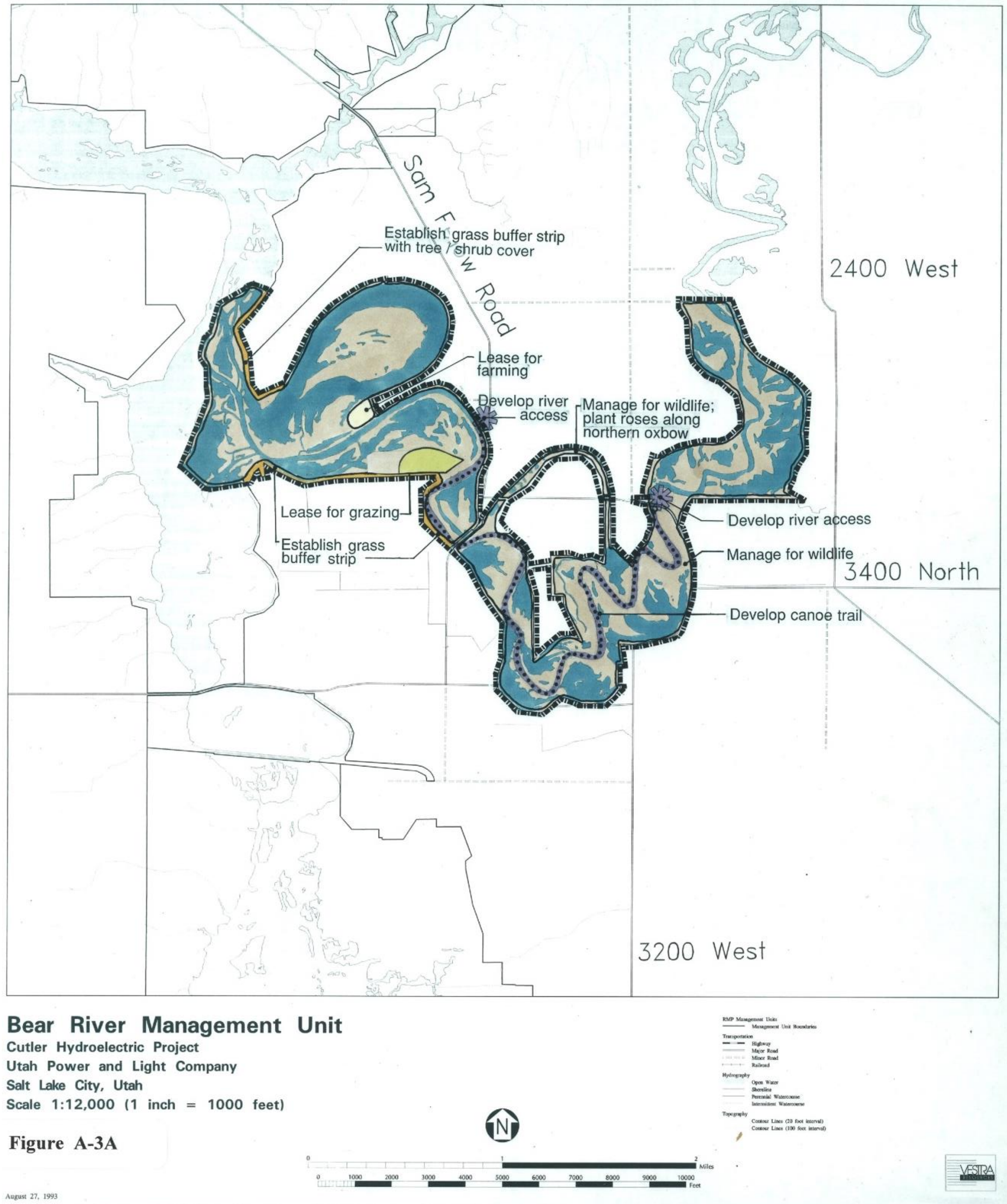
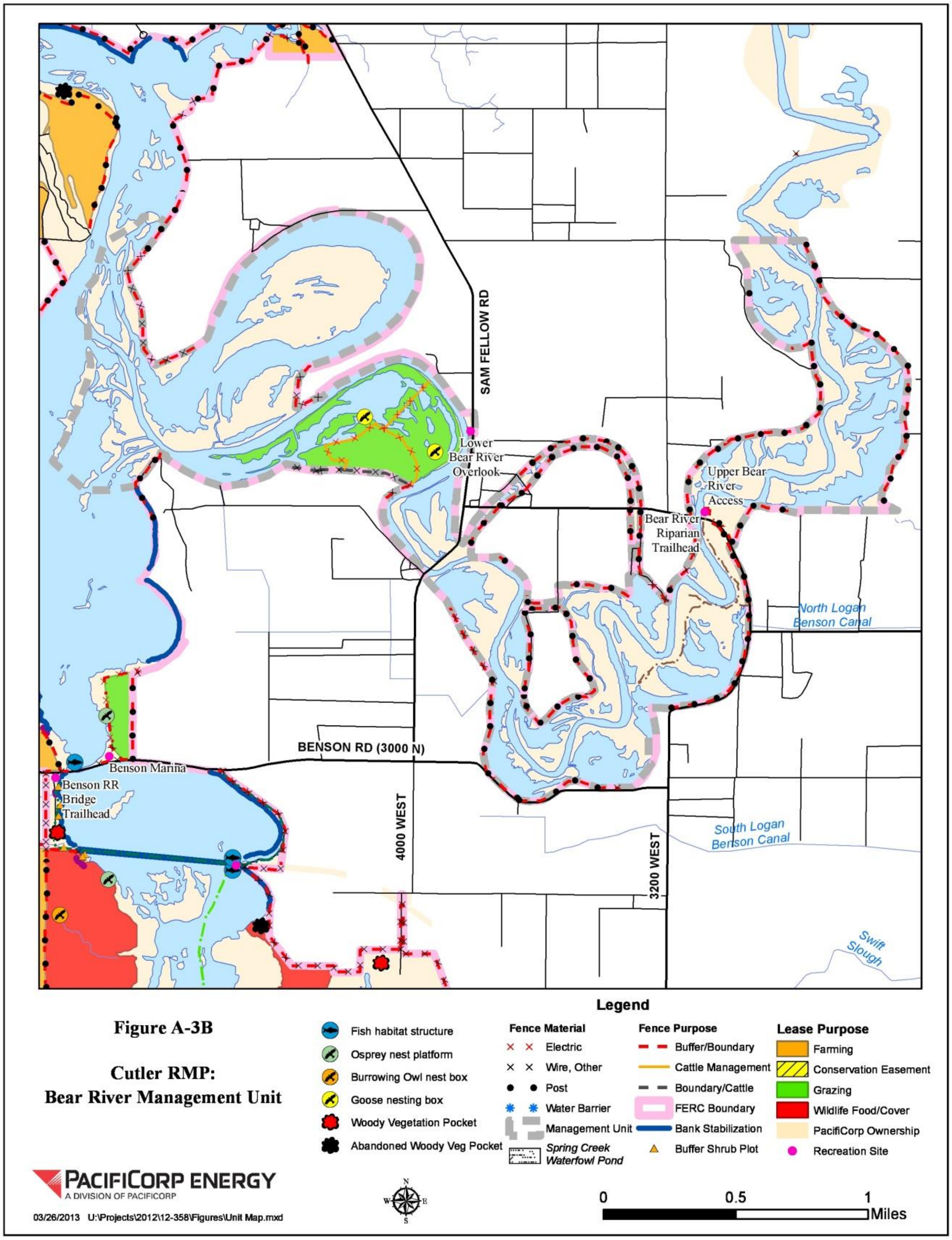


Figure A-2B

Cutler RMP: Reservoir Management Unit


Sam Fellow Road
Establish grass buffer strip with tree / shrub cover
2400 West
Lease for farming
Develop river access
Manage for wildlife; plant roses along northern oxbow
Lease for grazing
Establish grass buffer strip
Develop river access
Manage for wildlife
3400 North
Develop canoe trail
3200 West
Bear River Management Unit
Cutler Hydroelectric Project
Utah Power and Light Company
Salt Lake City, Utah
Scale 1:12,000 (1 inch = 1000 feet)
Figure A-3A
August 27, 1993


SAM FELLOW RD
Lower
Bear River
Overlook
Upper Bear
River
Access
Bear River
Riparian
Trailhead
North Logan
Benson Canal
BENSON RD (3000 N)
Benson Marina
Benson RR
Bridge
Trailhead
4000 WEST
South Logan
Benson Canal
3200 WEST
Swift
Slough
Legend
Figure A-3B
Cutler RMP:
Bear River Management Unit
Fish habitat structure
Osprey nest platform
Burrowing Owl nest box
Goose nesting box
Woody Vegetation Pocket
Abandoned Woody Veg Pocket
Fence Material
Electric
Wire, Other
Post
Water Barrier
Management Unit
Spring Creek
Waterfowl Pond
Fence Purpose
Buffer/Boundary
Cattle Management
Boundary/Cattle
FERC Boundary
Bank Stabilization
Buffer Shrub Plot
Lease Purpose
Farming
Conservation Easement
Grazing
Wildlife Food/Cover
PacifiCorp Ownership
Recreation Site
PACIFICORP ENERGY
A DIVISION OF PACIFICORP
03/26/2013 U:\Projects\2012\12-358\Figures\Unit Map.mxd
N
W
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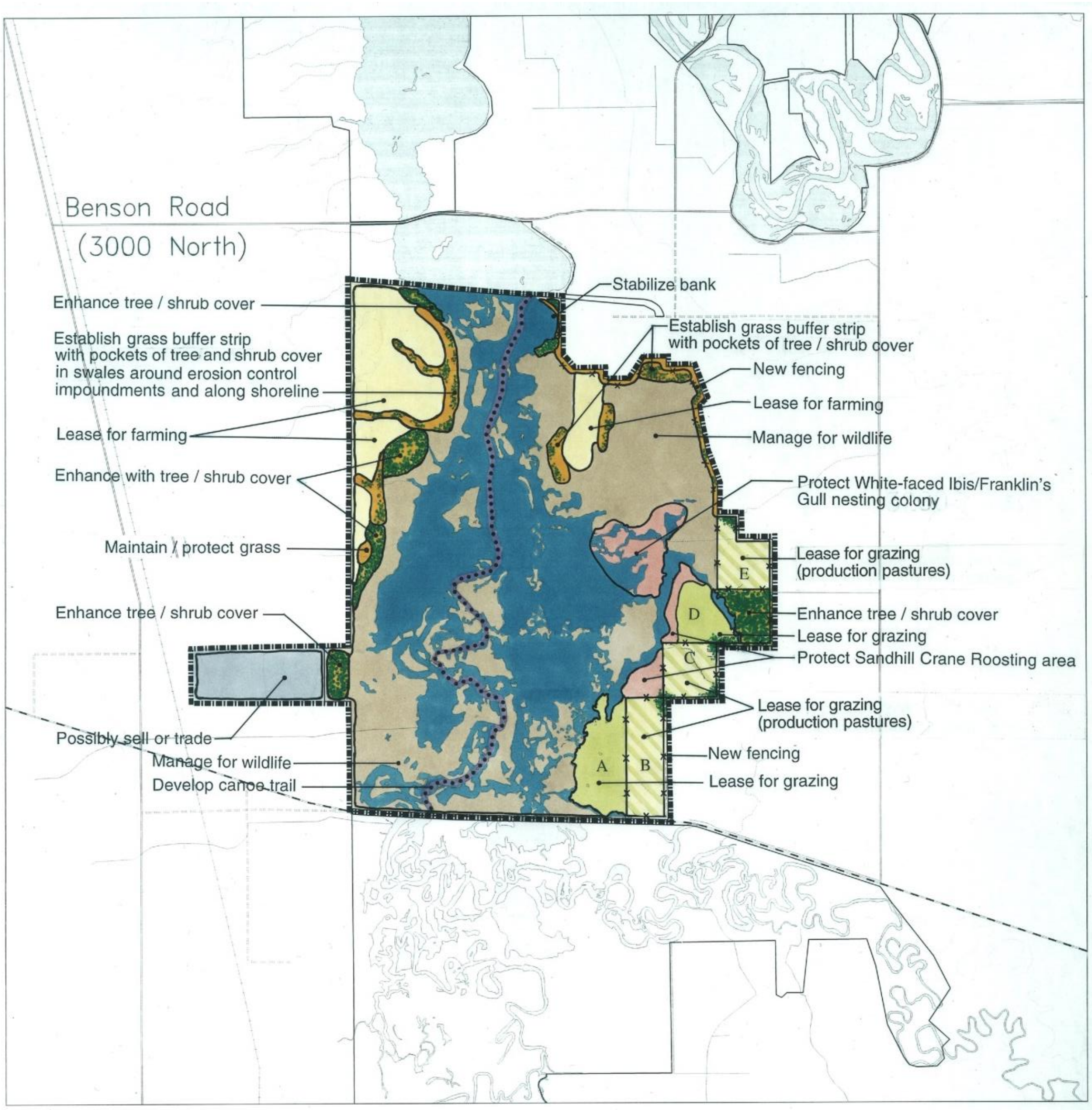
Miles



North Marsh Management Unit

Cutler Hydroelectric Project
Utah Power and Light Company
Salt Lake City, Utah
Scale 1:12,000 (1 inch = 1000 feet)

Figure A-4A

August 27, 1993

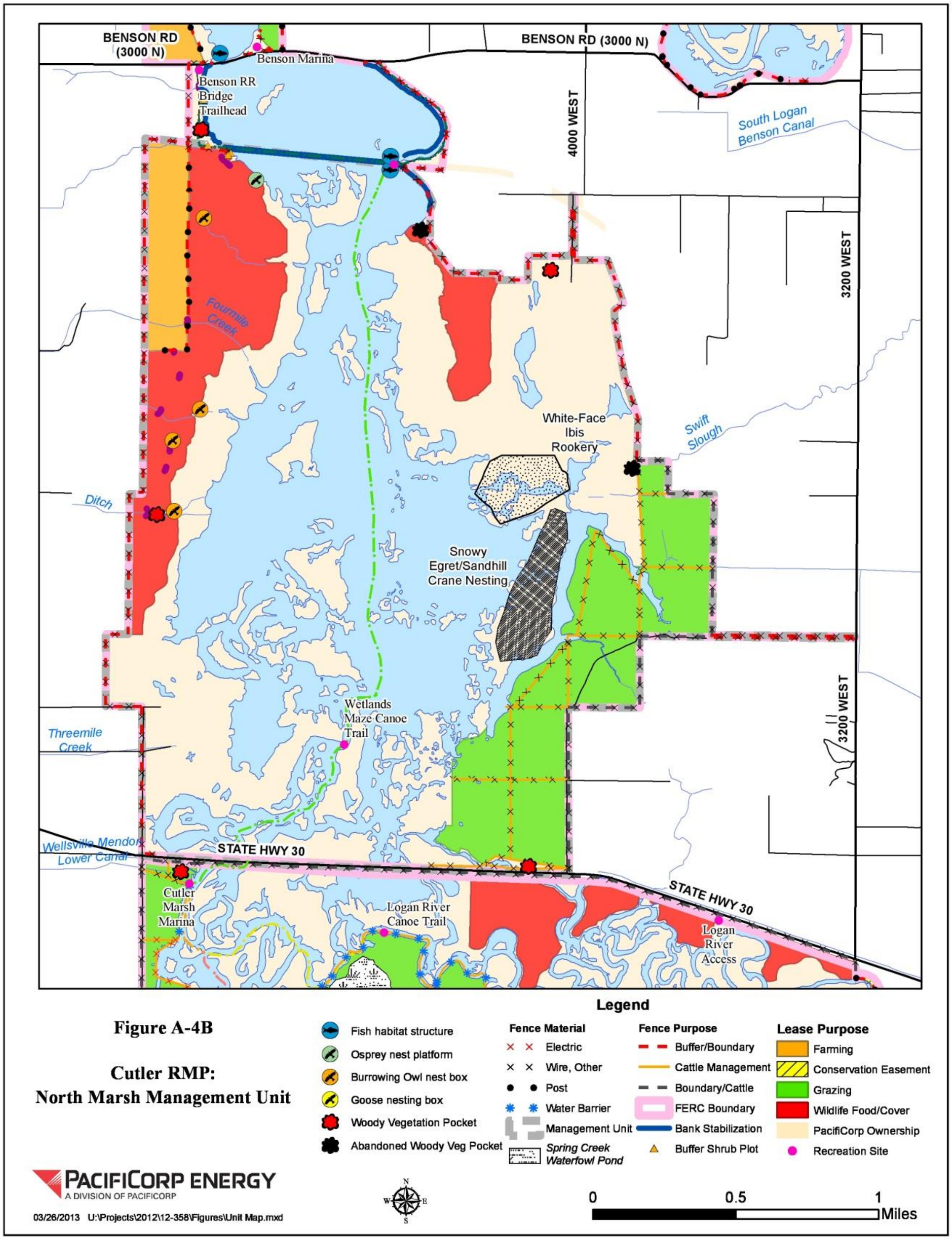
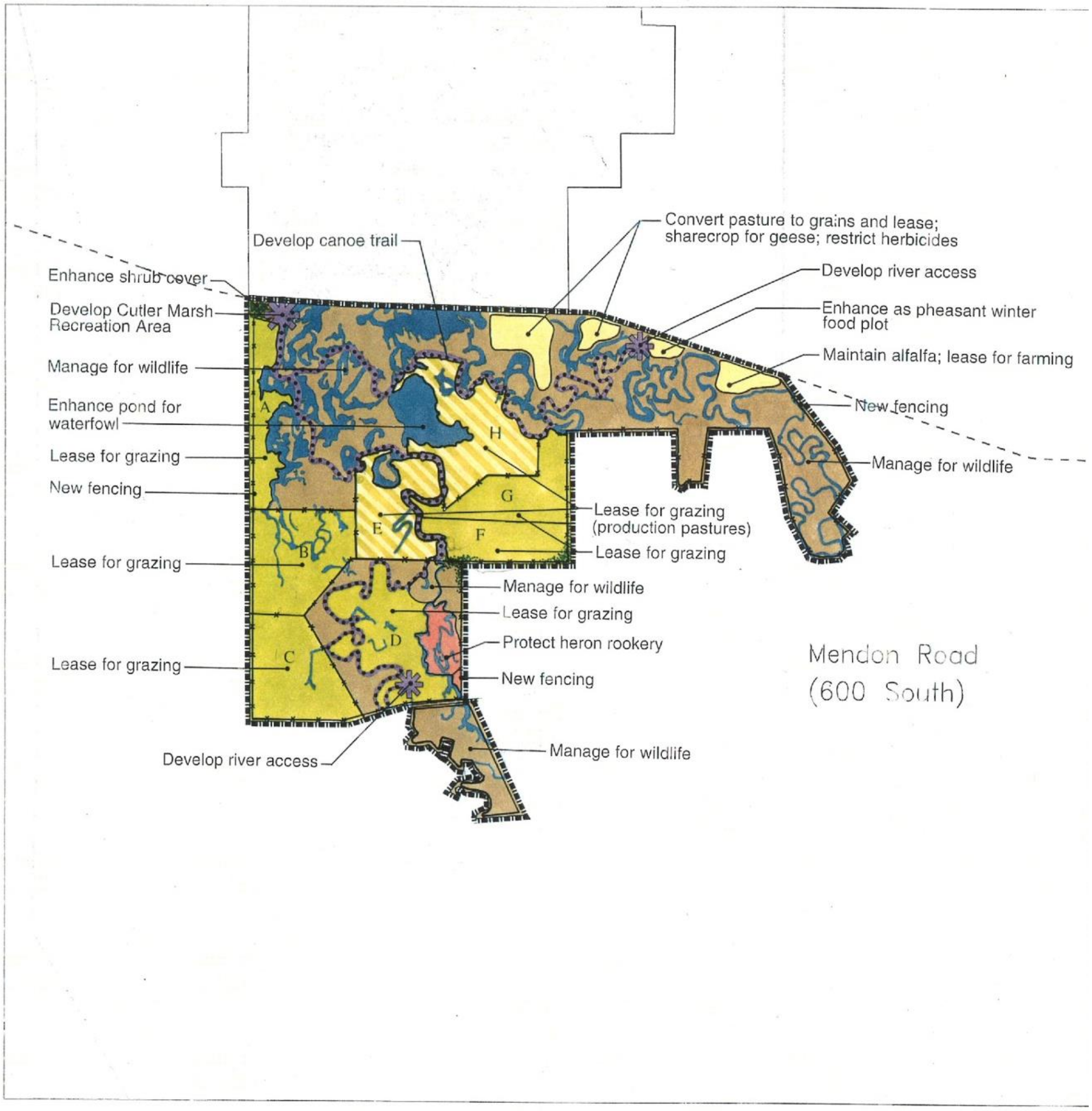


Figure A-4B

Cutler RMP:
North Marsh Management Unit



South Marsh Management Unit

Cutler Hydroelectric Project
Utah Power and Light Company
Salt Lake City, Utah
Scale 1:12,000 (1 inch = 1000 feet)

Figure A-5A

August 27, 1993

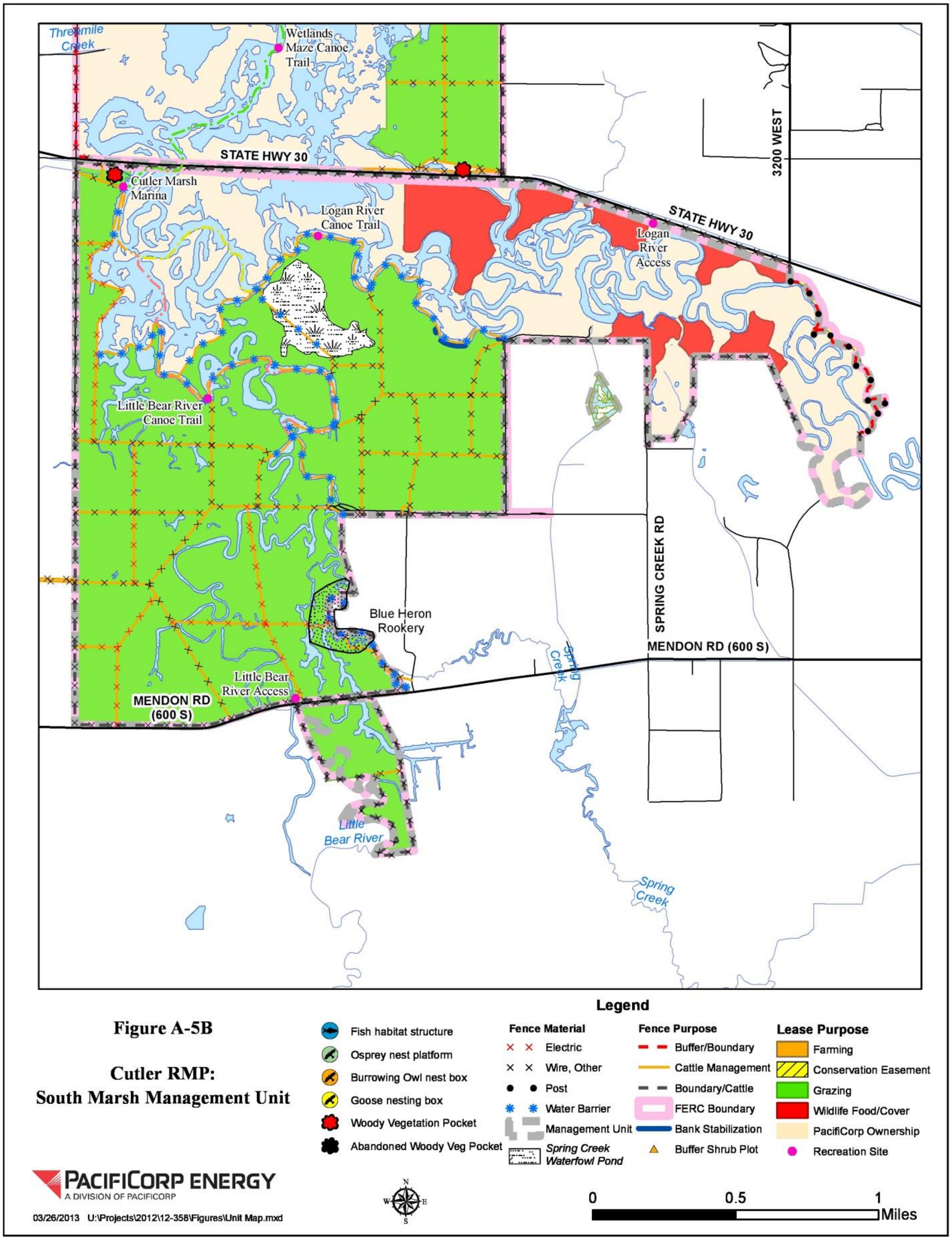


Figure A-5B

Cutler RMP: South Marsh Management Unit

APPENDIX B

VEGETATION ENHANCEMENT PROGRAM

APPENDIX B-1: SHORELINE BUFFERS AND WEED MANAGEMENT REPORT

APPENDIX B-2: BANK STABILIZATION

- Appendix B-2, Table B-2-1 presents a summary of the condition of each of the bank stabilization sites created as part of the vegetation enhancement program, including 2002 (baseline) and 2008-2012 data.

APPENDIX B-3: BOUNDARY BUFFER FENCES

- Appendix B-3, Table B-3-1 presents a summary of the condition of the boundary buffer fences monitored as part of the vegetation enhancement monitoring program, 2008-2012.

APPENDIX B-1

SHORELINE BUFFERS AND WEED MANAGEMENT REPORT

Table B-1-1. Buffer Parcel Overall Condition by Year.							
Buffer Identification		**Buffer Condition**					
ID No.	**Bank Name**	**2002 (baseline)**	**2008**	**2009**	**2010**	**2011**	**2012**
1	North Marsh West Buffer	Good	Good	Good	Good	Good	Good
2	Roundy CRP Buffer	Poor	Fair	Fair	Fair	Fair	Good
3	Roundy 300 ac Buffer	Good	Fair	Fair	Fair	Fair	Good
4	Railroad Trail West	Good	Poor	Poor	Poor	Fair	Good
5	Roundy Middle	Good	Good	Good	Good	Good	Good
6	Clay Slough	Poor	Poor	Poor	Poor	Poor	Poor
7	Roundy Big Bend B	Good	Fair	Fair	Good	Good	Good
8	Roundy North	Poor	Good	Good	Good	Good	Good
9	M Rigby	Poor	Fair	Fair	Fair	Fair	Fair
10	Griffin	Poor	At-Risk	At-Risk	At-Risk	At-Risk	At-Risk
11	B Ballard	At-Risk	Poor	Poor	Fair	Fair	Fair
12	B Ballard North	Poor	Poor	Poor	Poor	Poor	Poor
13	Newton Substation	Poor	Good	Good	Fair	Good	Good
14	Canyon/J. Benson	Good	Good	Good	Good	Good	Good
15	C Griffin	Good	Good	Good	Good	Good	Good
16	Railroad	Good	Good	Good	Good	Good	Good
17	Garth Benson	Poor	Good	Good	Good	Good	Good
18	Val J. Rigby	Poor	Fair	Good	Good	Good	Good
19	Stewart	At-Risk	Fair	Good	Good	Good	Good
20	Seamons	Good	Good	Good	Good	Good	Good
21	Rasmussen	Good	Good	Good	Good	Good	Good
22	Lindley	Poor	At-risk	Poor	Poor	Poor	Poor
23	Munk	Good	Good	Good	Good	Good	Good
24	T. Ballard	At-Risk	At-risk	Poor	Fair	Fair	Fair
25	T. Ballard South	At-Risk	Good	Good	Good	Good	Good
26	Church Farm	Good	Fair	Fair	At-Risk	At-Risk	At-Risk
27	Watterson House	Good	Good	Good	Good	Good	Good
28	Benson/Watterson	Good	Good	Good	Good	Good	Good
29	Archibald	At-Risk	Good	Good	Good	Good	Good
30	Larson (J shape)	Poor	Fair	Fair	Fair	Good	Good
31	Gull Point	Good	Good	Good	Good	Good	Good
32	Watterson 100 AC	Poor	Fair	Fair	Fair	Fair	Fair
33	Rose Oxbow	Good	Fair	Fair	Fair	Fair	Fair
34	H. Falslev Island	Good	Good	Good	Good	Good	Good
35	B. Reese	Good	Good	Good	Good	Good	Good
36	R. Reese	Excellent	Good	Good	Fair	Fair	Good
37	Thayne Gate	Poor	Fair	Fair	Fair	Fair	Fair
38	J Allen	Good	Excellent	Excellent	Excellent	Excellent	Excellent

Table B-1-1. Buffer Parcel Overall Condition by Year.							
Buffer Identification		**Buffer Condition**					
ID No.	**Bank Name**	**2002 (baseline)**	**2008**	**2009**	**2010**	**2011**	**2012**
39	T. Ballard-Benson	Good	Good	Good	Good	Good	Good
40	H Falslev	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
41	Benson Oxbow Road North	Good	Good	Good	Good	Good	Good
42	Hobbs	Poor	Poor	Poor	Fair	Poor	Poor
43	Z. Balls	Good	Excellent	Good	Good	Fair	Fair
44	Benson Oxbow Road	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
45	H. Johnson	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
46	Cardon South	Poor	Good	Good	Poor	Fair	Good
47	Newton Bridge West	At-Risk	At-Risk	Poor	Poor	Fair	Fair
48	Canyon-Peterson	Poor	Good	Good	Good	Good	Good
49	Canyon-Lofthouse	Good	Fair	Good	Good	Good	Good
50	Canyon-Salisbury	Good	Good	Good	Good	Good	Good
51	Canyon-Anderson	Good	Good	Good	Good	Good	Good
52	Canyon-Larson	Good	Good	Good	Good	Good	Good
53	Larry Falslev	n/a	Good	Good	Good	Good	Good
54	Larry Falslev Penn	n/a	Excellent	Excellent	Excellent	Excellent	Excellent
Green =Improvement in buffer condition from previous year Blue =Steady condition of the buffer with no change or improving from previous year. Red = Decline in buffer condition from the previous year.							

Weed Management Data

Cutler Hydroelectric Project
Resource Management Plan
Five-Year Monitoring Report
2008-2012

Prepared for

PacifiCorp

by

PMG vegetationcontrol

A Providia Management Company

February 2013

Introduction

The Cutler Reservoir resource area, located primarily in northern Utah's Cache County, is owned and managed by PacifiCorp as a natural asset that is associated with the Cutler Hydroelectric Project. Much of the 10,000-acre reservoir is actually a large, emergent marsh wetland. This resource is managed in compliance with the 1994 Resource Management Plan and the 2002 Cutler Monitoring Plan. Both plans address the need to proactively manage noxious and invasive weeds.

Noxious and invasive weeds pose a significant threat to ecosystems. There is much evidence that as weed populations increase, the amount of effort, time and money to control them also increases resulting in exponentially larger costs to restore functionality to these ecosystems. As such, it is essential to utilize all methods available to control current weed infestations, prevent new infestations, and protect non-infested lands. Ecological concerns associated with noxious weeds are numerous and include:

- Loss of wildlife habitat
- Increases in conflicts with adjacent landowners
- Loss of biodiversity
- Decreases in forage value for livestock and wildlife
- Loss/reduction of recreational opportunities such as hiking, biking, and wildlife viewing.
- Increases in soil erosion
- Disruption of soil and vegetation communities from changes in soil nutrient cycling.

Monitoring 2008-2012

Since 2008, the presence of weed populations has been monitored on an annual basis and in compliance with the Resource Monitoring Plan procedures for Grazing Lease Pastures and Buffer parcels. Weed populations were identified according to species by contractors trained in plant and weed identification. The following list of Utah state-listed and Cache county-listed weed species have been identified as present on PacifiCorp owned lands:

- Canada thistle (*Cirsium arvense*)
- Dyer's woad (*Isatis tinctoria*)
- Field bindweed (*Convolvulus arvensis*)
- Goatsrue (*Galega officianalis*)
- Hoary cress (*Cardaria draba*)
- Jointed goatgrass (*Aegilops cylindrical*)
- Musk thistle (*Carduus nutans*)
- Perennial pepperweed (*lepidium latifolium*)
- Poison hemlock (*Conium maculatum*)
- Russian knapweed (*Centaurea repens*)
- Scotch thistle (*Onopordum acanthium*)
- Purple loosestrife (*Lythrum salicaria*)

Weed species were also categorized into classes of density and abundance in each buffer parcel or grazing pasture. The classifications were defined as follows:

- Rare – Less than 10%
- Scattered – 10-50%
- Dominant – More than 50%

The next two sections summarize data collected since 2008 in the buffer parcels and grazing pastures.

Buffer Parcels

There are 54 shoreline buffer parcels at Cutler that are monitored yearly for weeds. During the monitoring period for this report, weed density decreased in three parcels due to focused weed control efforts. Weed populations were dynamic with changing precipitation and temperature that favored certain invasive species over others in each year.

Table B-1-2 Describes the level of weed infestation in each of the 54 buffers

Table B-1-2 Number of buffer zones in each weed infestation category, 2008-2012

	Rare	**Scattered**	**Dominant**	**Total**
2008	23	22	9	54
2009	25	21	8	54
2010	24	22	8	54
2011	27	21	6	54
2012	26	20	8	54

Rare- less than 10%
Scattered- 10-50%
Dominant- More than 50%

Changes in weed populations can be attributed to increased weed populations on adjacent lands, more thorough weed monitoring in later years, and prolonged drought that have stressed perennial vegetation. Dyer’s woad continues to be a concern for adjacent landowners in the buffer parcels near Cache-Junction, a historic railroad depot. This has placed greater priority on these locations and weed populations. While infestations on company lands are treated annually, re-infestation from the railroad right-of-way is extensive.

Grazing Pastures

There are 38 grazing pastures designated in the Agricultural Leasing Program associated with the Cutler Reservoir Resource Management Plan (not including one pasture that has been flooded out and is currently inaccessible). These pastures are monitored using procedures similar to those associated with buffer parcels. Table B-1-3 summarizes the abundance and density of weed species found in grazing pastures year by year.

Table B-1-3 Number of grazing pastures in each weed infestation category, 2008-2012

	Rare	**Scattered**	**Dominant**	**Total**
2008	17	21	0	38
2009	18	19	1	38
2010	19	19	0	38
2011	18	18	2	38
2012	21	17	0	38

Rare- less than 10%
Scattered- 10-50%
Dominant- More than 50%

2010 Integrated Weed Management Inventory

PacifiCorp personnel and contractors recognized the need to create an integrated approach to weed management. Mapping was conducted in 2006 and again in 2010 in connection with the monitoring that is prescribed in the Cutler Monitoring plan.

The maps of weed species located at Cutler Reservoir are placed at the end of this report. Table B-1-4 summarizes the data that were collected.

Table B-1-4 Summary of mapped weed species in 2006 and 2010

Common Names	**Scientific Names**	**Acreage 2006**	**Acreage 2010**
Thistle Species	*Total*	264 acres	153.37 acres
Scotch	*Onopordum acanthium*	54 acres	16.18 acres
Canada	*Cirsium arvense*	138 acres	117.72 acres
Musk	*Carduus nutans*	72 acres	0.08 acres
Bull	*Cirsium vulgare*	Not Mapped	19.39 acres
Field Bindweed	*Convolvulus arvensis*	106 acres	Not Mapped
Poison Hemlock	*Conium maculatum*	33 acres	21.19 acres
Dyer’s Woad	*Isatis tinctoria*	11 acres	4.67 acres

Table B-1-4 Summary of mapped weed species in 2006 and 2010			
Common Names	**Scientific Names**	**Acreage 2006**	**Acreage 2010**
Goatsrue	*Galega officinalis*	68 acres	82 acres*
Hoary Cress	*Cardaria draba*	8 acres	35.07 acres
Russian Knapweed	*Centaurea repens*	Not Mapped	0.80 acres
Purple Loosestrife	*Lythrum salicaria*	Not Mapped	95 plants
Total		490 acres	297.08 acres

* Approximated. Note that this inventory did not include the invasive common reedgrass , *Phragmites australis* as it is not currently listed as a noxious weed by the county. However, PacifiCorp is working with Utah State University to determine which *Phragmites* in the area may be the native grass, versus which may be the invasive non-native grass. This determination may help guide future management of invasive species.

2013 Integrated Weed Management Approach

Integrated Weed Management (IWM) is a multidisciplinary, holistic approach to managing noxious weeds and invasive species. IWM includes the use of an appropriate combination of education, prevention, proper land management practices, biological control agents, physical or mechanical methods, herbicide methods, and cultural methods. The methods for managing a given weed infestation depends on many factors such as access, growth form of the weed species, size of the weed patch, and the weather at the time of control. Strategies for managing weeds include pulling, mowing, cultural controls, livestock grazing, biological control agents, and herbicides.

PacifiCorp's contractor Providia Management Group (dba PMG Vegetation Control), under the guidance of company personnel developed several integrated strategies to effectively manage weed populations. This included the prioritization of weed species and management areas on an annual basis.

PacifiCorp has been cooperating with the Cache County Weed Supervisor to manage infestations of purple loosestrife by collecting and distributing beetles that depredate on the foliage of this plant. Effective control has been attained in the past two years. The loosestrife populations are currently so small and dispersed that it may be difficult for beetle populations to become established.

Table B-1-5 summarizes data all types of treatments in 2012.

Table B-1-5 Summary of weed treatments in 2012	
Chemical	171.2 acres
Mowing	4.3 acres
Hand cutting/pulling	None

Chemical treatments used three different chemicals depending on the species being treated and timing of treatments. Treatments included Veteran, Telar, and Milestone. Each was applied according to the requirements described in the labels. Figures B-1A-E illustrate GPS data collected from broadcast herbicide treatment of priority weed species.

Mowing was completed in the areas where chemical treatment was not appropriate or in areas where chemical treatment would not have prevented seed maturation. Vegetation was also mowed along the RR Trail to prevent damage to the trail surface and provide additional safety for users.

PacifiCorp is coordinating with Utah State University (USU) in conducting research on goatsrue. Several plots testing the effectiveness and the residual time of chemicals were utilized in 2007 and 2008 on pasture in the North Marsh. The USDA is also conducting rate of spread research for this species near the Benson Marina.

2013 Integrated Weed Management Strategies

PacifiCorp will continue to work with PMG Vegetation Control in implementing an integrated approach to weed management. IWM takes time to fully develop and demonstrate significant progress. The following strategies will be implemented in 2013.

1- Continued refinement of weed inventories.
2- Chemical treatments of priority one and two species.
3- Continued coordination with the Cache County Weed Supervisor
4- Continued cooperation in noxious weed and invasive weed species research with USU and USDA.

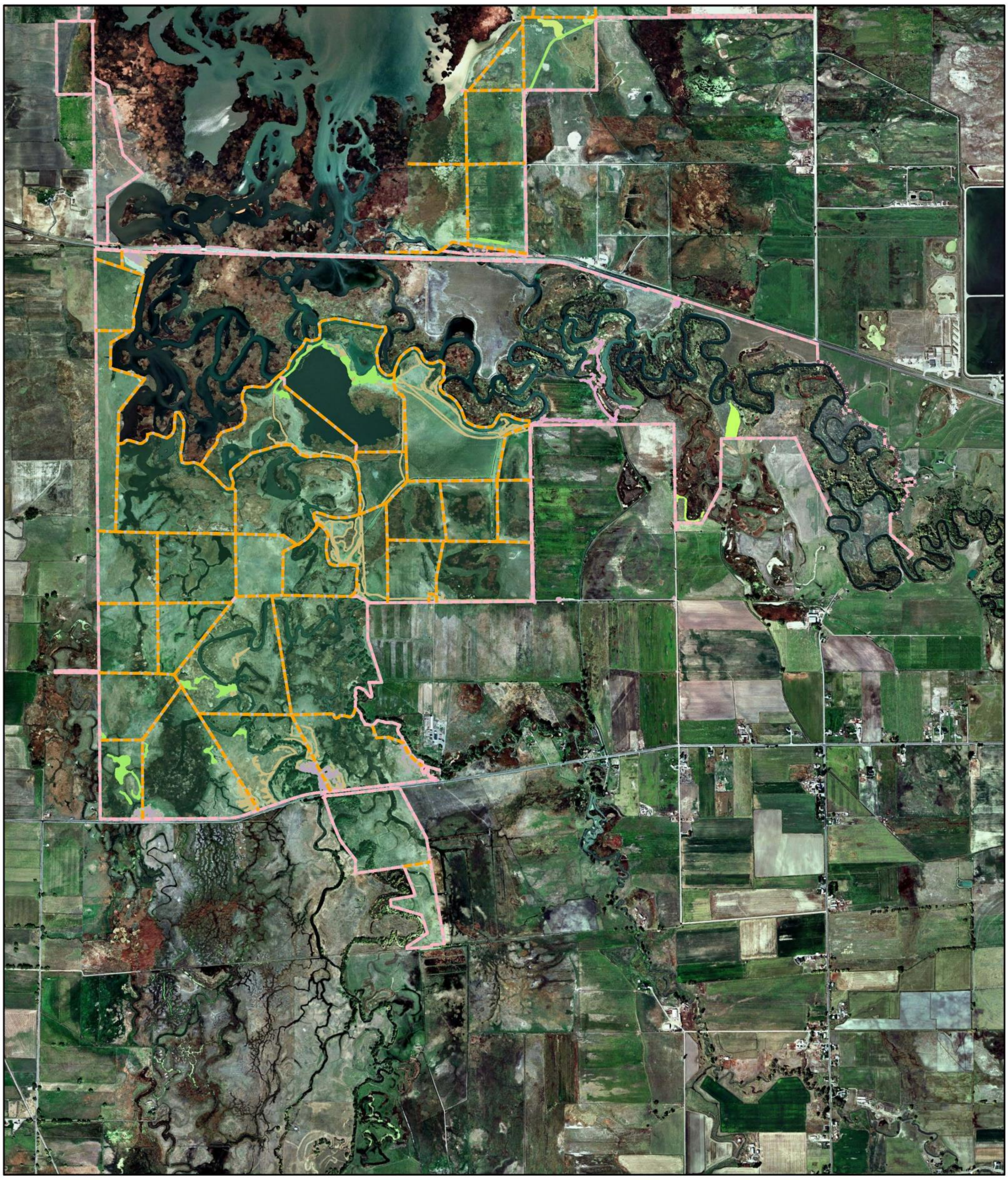


Figure B-1A

Cutler RMP:
South Marsh Management Unit
Broadcast Weed Control
2008-2012

Broadcast Treatment
Areas : Year
2008
2009
2010
2011
2012

Management Fence
Lines
Grazing Management Fence
Lines
Buffer Boundary Posts
Points
Grazing Pasture Area
Areas
Buffer Management Area
Areas

PMG
vegetationcontrol

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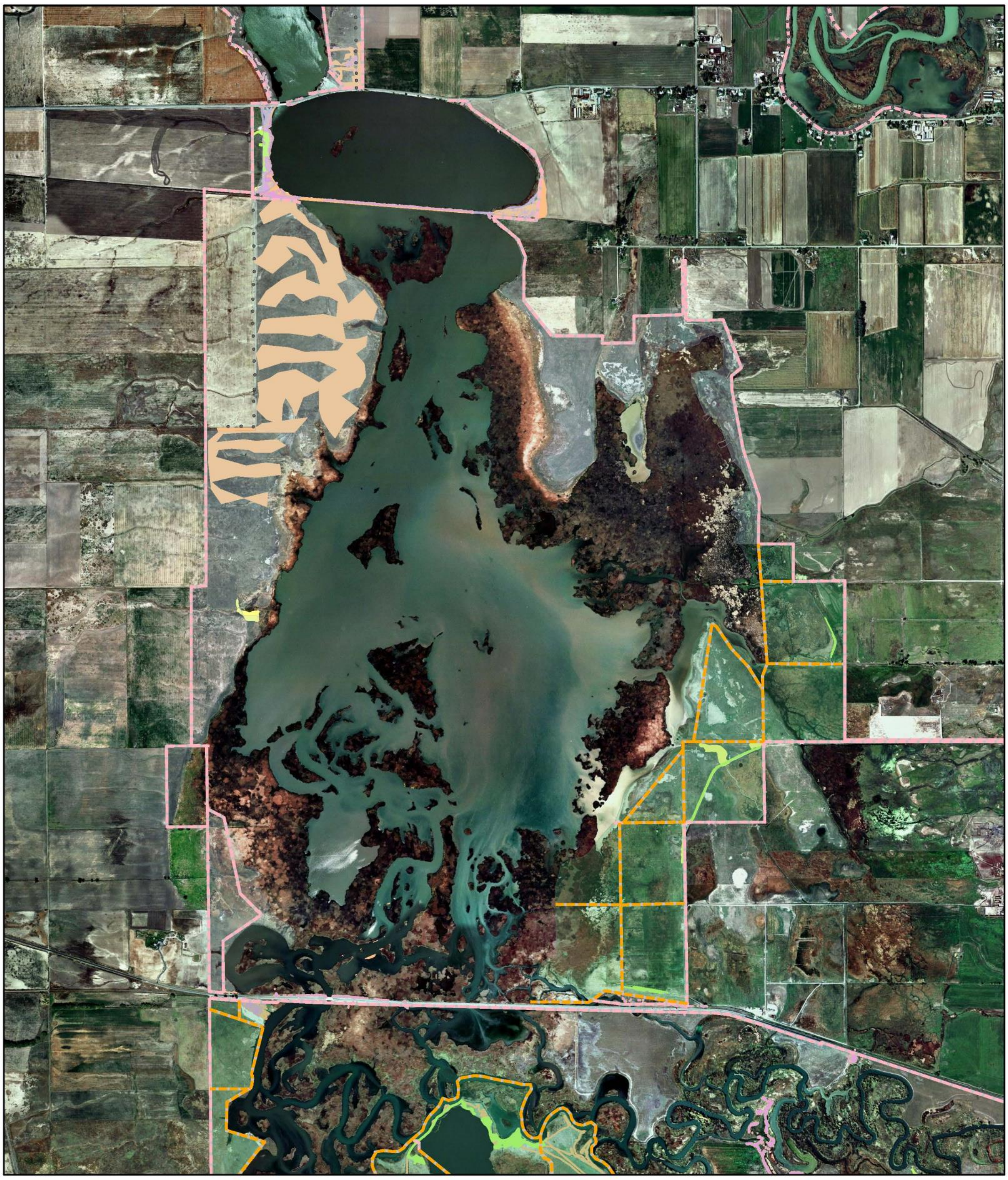

Figure B-1B

Cutler RMP:
North Marsh Management Unit
Broadcast Weed Control
2008-2012

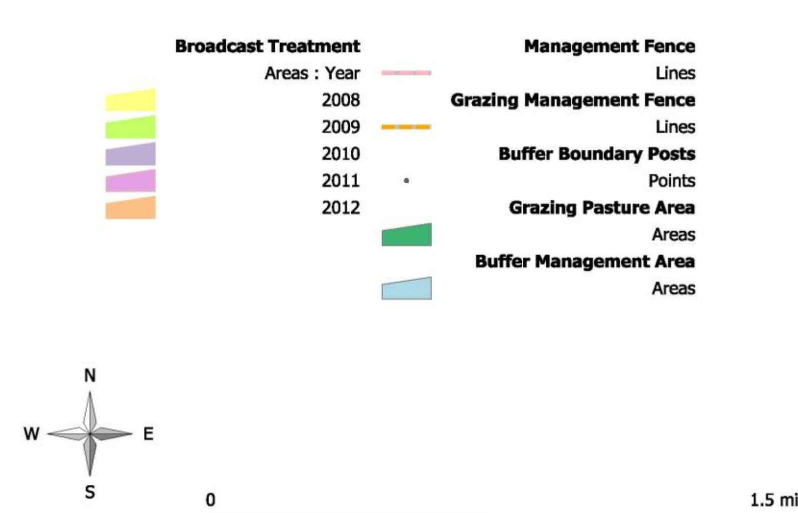

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Figure B-1C

Cutler RMP:
Reservoir Management Unit
Broadcast Weed Control
2008-2012

Broadcast Treatment
Areas : Year
2008
2009
2010
2011
2012

Management Fence
Lines
Grazing Management Fence
Lines
Buffer Boundary Posts
Points
Grazing Pasture Area
Areas
Buffer Management Area
Areas

PMG vegetationcontrol

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W E
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Figure B-1D

Cutler RMP:
River Management Unit
Broadcast Weed Control
2008-2012

Broadcast Treatment	
Areas : Year	
2008	
2009	
2010	
2011	
2012	

Management Fence
Lines
Grazing Management Fence
Lines
Buffer Boundary Posts
Points
Grazing Pasture Area
Areas
Buffer Management Area
Areas

PMG vegetationcontrol

N W E S

0 1.5 mi

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Figure B-1E

Cutler RMP:
Canyon Management Unit
Broadcast Weed Control
2008-2012

Broadcast Treatment Areas : Year		Management Fence	
	2008		Lines
	2009	Grazing Management Fence	Lines
	2010	Buffer Boundary Posts	Points
	2011		
	2012	Grazing Pasture Area	Areas
		Buffer Management Area	Areas

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APPENDIX B-2

BANK STABILIZATION

Table B-2-1 presents a summary of the condition of each of the bank stabilization sites created as part of the vegetation enhancement program, including 2002 (baseline) and 2008-2012 data.

Table B-2-1. Summary of Cutler Reservoir Bank Stabilization								
Project Identification		**Bank Lengths**	**Functioning Condition of Bank Stabilization Structure by Year**					
ID	**Bank Name**	**Feet/Miles**	**2002 (baseline)**	**2008**	**2009**	**2010**	**2011**	**2012**
1	J Benson	783.20/0.148	Good	Good	Good	Good	Good	Good
2	G Benson	964.20/0.183	Good	Good	Good	Good	Good	Good
3	GB South	752.81/0.143	Good	Good	Good	Good	Good	Good
4a	Stewart West	2836.86/0.537	Poor	Good	Good	Good	Good	Good
4b	Stewart East	1247.91/0.236	Poor	Poor	Poor	Poor	Fair	Fair
5	Ballard	1486.78/0.282	Poor	Good	Good	Good	Good	Good
6	Watterson Rip-Rap	1749.753/0.331	Good	Good	Good	Good	Good	Good
7	Watterson Gabions	2238.14/0.424	Good	Good	Good	Good	Good	Good
8	Archibald	2897.58/0.589	Good	Good	Good	Good	Good	Good
9	Larson	1148.51/0.218	Good	Good	Good	Good	Good	Good
10	Spring Creek	618.26/0.117	Good	Good	Good	Good	Good	Good
11	RR Trail West	1199.82/0.227	Poor	Good	Good	Good	Good	Good
12	Benson West	551.52/0.104	Fair	Good	Good	Good	Good	Good
13	Near Check dam 12	831.03/0.0157	Poor	Good	Good	Good	Good	Good
14	Roundy Pump	819.095/0.155	Good	Good	Good	Good	Good	Good
15	Middle Roundy	858.09/0.163	Good	Good	Good	Good	Good	Good
16	Upper Roundy	2442.22/0.463	Good	Good	Good	Good	Good	Good
Blue = Steady condition of the bank with no change from the previous year. Green= Improvement in bank condition from the previous year. Red = Decline in bank condition from the previous year.								

APPENDIX B-3
BOUNDARY BUFFER FENCES

Table B-3-1 presents a summary of the condition of the boundary buffer fences monitored as part of the vegetation enhancement monitoring program, 2008-2012.

Table B-3-1 Buffer/Boundary Fence Condition by Year (note now monitored by exception).						
Buffer Identification		**Fence Condition**				
ID No.	**Buffer Name**	**2008**	**2009**	**2010**	**2011**	**2012**
1	North Marsh West Buffer	Complete	Complete	Complete	Complete	Complete
2	Roundy CRP Buffer	Complete	Complete	Complete	Complete	Complete
3	Roundy 300ac Buffer	Complete	Complete	Complete	3 posts replaced	Complete
4	Rail Trail West	Complete	Complete	Complete	Complete	Complete
5	Roundy Middle	Complete	Complete	1 post replaced	Complete	5 posts missing/ongoing
6	Cowley Slough	Complete	Complete	Complete	Complete	Complete
7	Roundy Big Bend B	Complete	Complete	Complete	2 post replaced	Complete
8	Roundy North	Complete	Complete	Complete	Complete	Complete
9	M Rigby	Complete	Complete	Complete	Complete	4 posts replaced
10	Griffin	Complete	Complete	Several Posts missing	Several posts missing	Several posts missing
11	B. Ballard	Complete	Complete	Complete	Complete	Complete
12	B. Ballard North	Complete	Complete	Complete	Complete	Complete
13	Newton substation	Complete	Complete	2 posts replaced	Complete	Complete
14	Canyon/J. Benson	Complete	Complete	Complete	Complete	Complete
15	C Griffin	Complete	Complete	Complete	Complete	Complete
16	Railroad	Complete	Complete	Complete	Complete	Complete
17	G. Benson	Complete	Complete	Complete	Complete	Complete
18	V. Rigby	Complete	Complete	Complete	Complete	1 post replaced
19	Stewart	Complete	Complete	Complete	Complete	Complete
20	Seamons	Complete	Complete	Complete	Complete	Complete
21	Rasmussen	Complete	Complete	Complete	Complete	Complete
22	Lindley	Complete	Complete	Complete	Complete	Complete
23	Munk	Complete	Complete	Replaced 2 posts	Complete	Complete

Table B-3-1 Buffer/Boundary Fence Condition by Year (note now monitored by exception).						
Buffer Identification		**Fence Condition**				
ID No.	**Buffer Name**	**2008**	**2009**	**2010**	**2011**	**2012**
24	T. Ballard	Additional posts needed	Additional posts added	Complete	Complete	Complete
25	T. Ballard South	Additional posts needed	Additional posts added	Complete	Complete	2 posts replaced
26	Church Farm	Fences cut for pivot and cattle	Fences cut for pivot and cattle	Fences cut for pivot and cattle	Fences cut for pivot and cattle	All repaired and complete
27	Watterson House	Complete	Complete	Complete	Complete	Complete
28	Benson/Watterson	Complete	Complete	Complete	Complete	Complete
29	Archibald	Complete	Complete	Complete	Complete	Some repairs, complete
30	Larson (J Shape)	Complete	Complete	Complete	complete	Complete
31	Gull Point	Complete	Complete	Complete	Complete	Complete
32	Watterson 100 AC	Complete	Complete	Complete	Complete	Complete
33	Rose Oxbow	Complete	Complete	Complete	Complete	Complete
34	H. Falslev Island	Complete	Complete	1 post replaced	Several posts missing	Several posts missing
35	B. Reese	Complete	Complete	Complete	2 posts damaged	2 posts damaged
36	R. Reese	Complete	Complete	Complete	Complete	Complete
37	Thayne Gate	Complete	Complete	Complete	Complete	Complete
38	J. Allen	Complete	Complete	Complete	Complete	Complete
39	T. Ballard-Benson	Complete	Complete	Complete	Complete	Complete
40	H Falslev	3 posts missing	3 posts replaced	Complete	Complete	Complete
41	Benson Oxbow Rd North	Complete	2 post replace	Complete	Complete	1 post replaced
42	Hobbs	Complete	Complete	Complete	Complete	Complete
43	Z. Balls	Complete	Complete	Complete	Complete	Complete
44	Benson Oxbow Rd	Complete	Complete	Complete	Complete	Complete

Table B-3-1 Buffer/Boundary Fence Condition by Year (note now monitored by exception).						
Buffer Identification		**Fence Condition**				
ID No.	**Buffer Name**	**2008**	**2009**	**2010**	**2011**	**2012**
45	H. Johnson	Complete	Complete	Complete	Complete	Complete
46	Cardon South	Complete	Complete	Complete	Complete	Complete
47	Newton Bridge West	Complete	Complete	Complete	Complete	Complete
48	Canyon-Peterson	Complete	Complete	Complete	Complete	Complete
49	Canyon-Lofthouse	Complete	Complete	Complete	Complete	Complete
50	Canyon-Salisbury	Complete	Complete	Complete	Complete	Complete
51	Canyon-Anderson	Complete	Complete	Complete	Complete	Complete
52	Canyon-Larson	Complete	Complete	Complete	Complete	Complete
53	L. Falslev	Complete	Complete	Complete	1 post missing	1 post missing
54	L. Falslev penn	Complete	Complete	Complete	Complete	Complete

APPENDIX C

WILDLIFE MONITORING DATA

Ibis Data Summary

Provided by Bridgerland Audubon Society

Cutler Marsh Important Bird Area of Global Significance

In 1985, Birdlife International initiated the Important Bird Area (IBA) program to designate habitats especially important for one or more species of birds. Designation is voluntary and does not compel the landowner to manage the resource in any particular way. However, it does serve as a means to focus attention and resources on those places scientifically established as the most important and essential habitats. Three levels of designation—state, continental, or global—are used to distinguish places of importance to increasingly broader geographies.

In 1995, Birdlife International designated the National Audubon Society as the lead organization for designating and monitoring Important Bird Areas in the United States. The first five IBAs in Utah were designated in 2003. The Cutler Marsh/Amalga Barrens IBA in Cache County was one of ten added in 2005. There are currently 21 IBAs in Utah.
In 2008, after breeding season counts established that up to 5 percent of the hemispheric population of White-faced Ibis (*Plegadis chihi*) nested on islands in Cutler Marsh, that IBA was re-categorized as a Globally Important Bird Area.

The protocol for counting the Cutler Marsh White-faced Ibis is limited to counting birds flying above the rookery to avoid disturbing the rookery by walking through it. However, this protocol results in a substantial undercount of the birds actually using the rookery, though the magnitude of the resulting error is unknown. Official counts between 2008 and 2010 include:

Date	Count
05/16/08	1683
6/1/2008	239
6/14/2008	1237
5/12/2009	7311
5/26/2009	1526
6/12/2009	4230
7/1/2009	4959
7/15/2009	1601
5/22/2010	3158
6/9/2010	501
6/19/2010	1695

In 2012, the rookery was found to have moved west to other, more isolated islands in the marsh. No official counts were conducted, but observers reported at least several thousand birds in late June.

APPENDIX D

AGRICULTURAL LEASES

APPENDIX D-1: CLIMATE DATA

- **Climate Data for the Cutler Area by Calendar Year, 2008-2012 (Source: Utah Climate Center)**

APPENDIX D-2: CUTLER ANNUAL AGRICULTURAL LEASE DATA

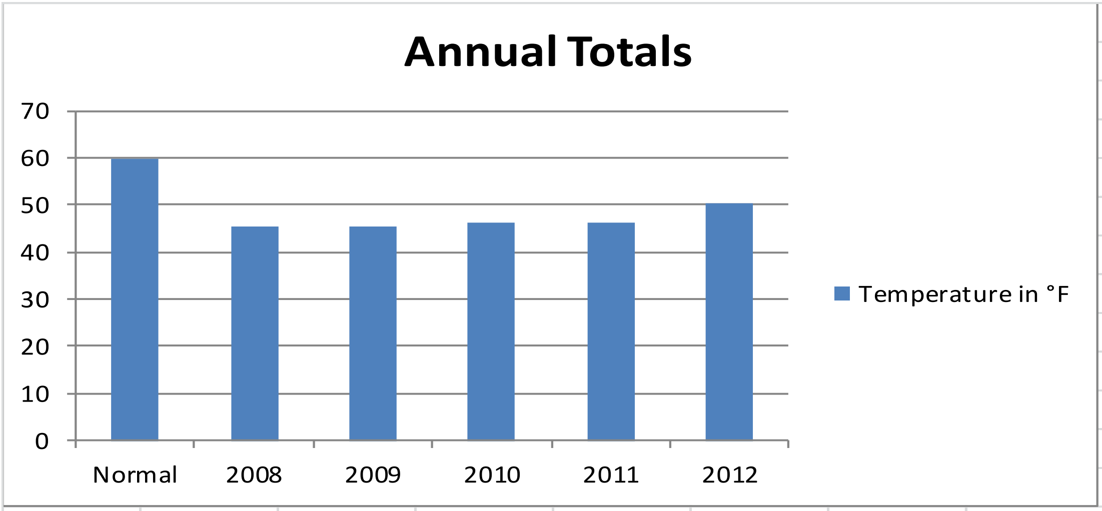
- **Summary of Cutler Annual Grazing Animal Unit Month (AUM) and Farm Lease Data**

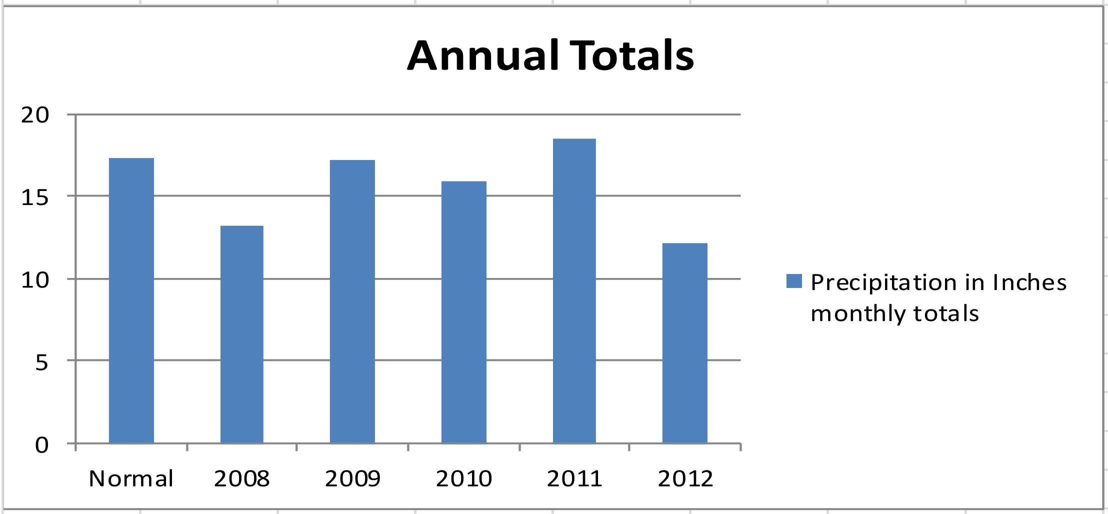
APPENDIX D-3: CATTLE MANAGEMENT FENCE MONITORING DATA

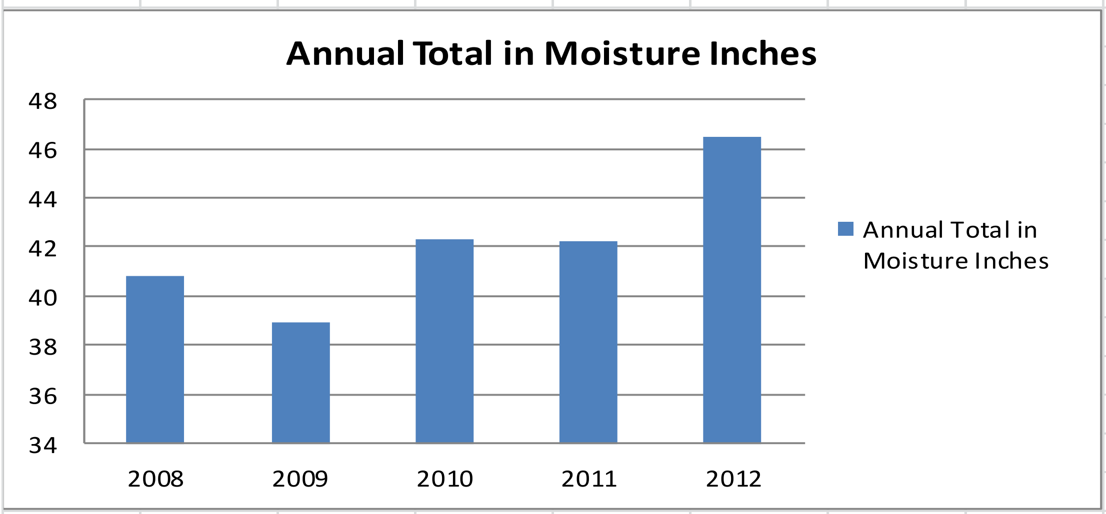
- **Summary of Cattle Management Fence Monitoring Results by Year, 2008-2012**

APPENDIX D-4: PROPERTY INCIDENT SUMMARY DATA

- **Summary of PacifiCorp's Property Incident Forms for the Current Monitoring Period, 2008-2012.**







Appendix D-1. Climate Data

Appendix D-2. Cutler Annual Grazing Pasture AUM and Farm Lease Data.				
Grazing Leases	**Expiration Date**	**# of Animals**	**Acres**	**Grazing Period**
Walker, Kelly	30-Apr-13		255	
		75 AUM		June 1 to Nov 4, 2008
		90 AUM		June 6 to Nov 6, 2009
		89 AUM		June 10 to Oct 15, 2010
		85 AUM		June 10 to Oct 29, 2011
		85 AUM		June 1 to Nov 5, 2012
Willmore, Harry & Tom	30-Apr-14		121	
		28 AUM		June 1 to Nov 4, 2008
		28 AUM		June 6 to Nov 6, 2009
		28 AUM		June 10 to Oct 15, 2010
		28 AUM		June 10 to Oct 29, 2011
		28 AUM		June 1 to Oct 19, 2012
Utah State University	30-Nov-12		361	
		107.5 AUM		June 2 to Oct 31, 2008
		101.5 AUM		June 1 to Nov 9, 2009
		101.5 AUM		June 1 to Oct 11, 2010
		101.5 AUM		July 18 to Dec 3, 2011
		101.5 AUM		June 1 to Oct 19, 2012
Rinderknecht, Odell	30-Jun-13		85	
		90 AUM		Nov 29 to Jan 16, 2008/09
Selman, Bret	30-Apr-13		300	
North Marsh		68 AUM		May 28 to Sept 25, 2008
		71 AUM		June 6 to Oct 15, 2009
		71 AUM		June 10 to Oct 15, 2010
		70 AUM		June 6 to Sept 16, 2011
		69 AUM		June 1 to Oct 19, 2012
Hardman, Heber	31-May-14		80	
		49.7 AUM		June 1 to June 30, 2008
		50.2 AUM		June 6 to July 5, 2009
		49.8 AUM		June 6 to June 27, 2010
		30.5 AUM		July 10 to July 24, 2011
		40.5 AUM		June 16 to July 15, 2012
Watterson, Jim & Barbara	31-Mar-24		125	
		55 AUM		June 1 to Dec 1, 2009
		55 AUM		June 3 to Sept 15, 2010
		12 AUM		June 20 to Sept 10, 2011
		10 AUM		June 10 to Aug 31, 2012

Appendix D-2. Cutler Annual Grazing Pasture AUM and Farm Lease Data.				
Grazing Leases	**Expiration Date**	**# of Animals**	**Acres**	**Grazing Period**
Selman, Bret	23-Jun-12		260	
---Cutler Canyon		83.5 AUM		May 9 to June 18, 2008
		76.5 AUM		May 17 to June 30, 2009
		24 AUM		May 17 to June 22, 2010
		59.5 AUM		May 17 to June 22, 2011
		40.6 AUM		May 10 to June 23, 2012
Farming Leases	**Expiration Date**		**Acres**	
Roundy Farms Partnership	31-Dec-18		419.44	
Robert & Jeannine Munk	31-Mar-24		14.8	
Ballard Hog Farm	31-Dec-14		25.9	
Wendy Larson	2024		13.25	

Appendix D-3 Cattle Management Fence Condition (by exception) from 2008-2012					
Pasture Name	**2008**	**2009**	**2010**	**2011**	**2012**
SG3A	Realigned electric fence and replaced controller	Complete	Complete	Complete	Complete
SG1A/B	Complete	Rebuilt electric fence segments.	Complete	Complete	Complete
NG5	Complete	Complete	Complete	Need to rebuild south fence. Due to adjacent cattle pressure.	Rebuilt barbed-wire fence on south side of pasture.

Appendix D-4. Property Coordination, Cutler Five-Year Report 2008-2012					
Date Encroachment Recorded	**Adjacent Landowner/Buffer Segment**	**Property Issue**	**Notes**	**Proposed Resolution**	**Completed/Date**
7/15/2009	T. Ballard	Planting within the new buffer. Encroachment sweeps into the buffer 5-15 feet.	Review GPS post data and check for missing posts. Meet with Todd Ballard to discuss the solution and payment for additional posts and re-seed.	Complete	Fall, 2009
7/15/2009	Munk	Post missing by pumphouse	Re-set post a little north of pumphouse. Call Munks to find out why post removed.	Pole replaced. Will monitor for '10. Complete.	Fall 2009
7/15/2009	Newton Substation	Planting and cutting of hay on our property. A post was also cut down.	Dave to contact neighbor about cutting/leasing.	Consider a lease or fencing the property line	Ongoing Resolution 1
7/15/2009	P. Cardon - Church Farm	Fence cut in one area and wheel line swinging onto our property in one area.	Legal is working out these issues.		Ongoing Resolution 2
7/15/2009	P. Cardon - South	Gate was open, stray cow on our property.	Team to visit. Gate should be closed. If not gate to pump house, put lock on gate.	Completed	Fall 2009

Appendix D-4. Property Coordination, Cutler Five-Year Report 2008-2012					
Date Encroachment Recorded	**Adjacent Landowner/Buffer Segment**	**Property Issue**	**Notes**	**Proposed Resolution**	**Completed/Date**
7/15/2009	W. and L. Roundy	Furadan used and several dead geese found. Ditch has been added to drain into marsh.	Call Roundys to ask where specifically on our ground pesticide was applied, what pesticide, what dates. Same questions to landowner immediately adjacent to ours. Also, ditch that was added can drain the field but needs to end at the buffer line.	Met with W. Roundy for confirmation of locations of pesticide application and reiterated the need for prior notification of any pesticides. Complete.	Fall 2009
7/15/2009	R. Reese	Bonfire picnic area, ditch out of pond and cows down by the river	Add post to east corner of property (near water). Locate property owner to south of this area. FERC/ownership and fence lines don't match in this area and need to be fixed. Peninsula area cannot have road. Inquire about pond overflow. How will he resolve?	Met and discussed issues. Reese will notify his son of peninsula use. Complete.	Fall 2009
7/15/2009	L. Cowley – Cowley Slough	Unpermitted bank stabilization	Make appt with Cowley to discuss.	Monitor for next year. Complete	Fall 2009
7/15/2009	Utah State University	Wheel lines, garbage, etc dumped on our property	Visit site to review status. Speak w/USU about getting stuff off our property.	Met with USU representative and discussed clean-up issues. USU was to remove by end of October. Check in spring '10 to see if completed.	Spring 2010

Appendix D-4. Property Coordination, Cutler Five-Year Report 2008-2012					
Date Encroachment Recorded	**Adjacent Landowner/Buffer Segment**	**Property Issue**	**Notes**	**Proposed Resolution**	**Completed/Date**
7/15/2009	Griffin	Still planting on our property	Contact Griffin to let him know that we will be planting that area this fall. Follow-up w/letter.	Communication given for spraying, will follow-up for future encroachments. Complete.	Fall 2009
7/15/2009	H. Falslev	Missing posts	Posts have been replaced. Find out name of who is running land.	Kevin Falslev is now running this ground. Will continue to monitor for future. Complete.	Fall 2009
7/15/2009	Benson Oxbow Rd. N.	Post missing where road comes to a T at stop sign by church.	Brian to check post data on oxbow road for missing posts.	Fix.	Spring 2010
7/15/2009	Seamons	Post missing	Brian to check post data for missing posts. Todd Ballard now running land.	Fix.	Spring 2010
7/15/2009	V. Rigby	Cutting hay on buffer	Team to visit.	Follow-up on possible cutting.	Ongoing Resolution 3
4/9/2010	UDOT	UDOT dumping dirt on our property near Newton bridge.	Follow-up with UDOT contact and discuss resolution.	UDOT removed equipment. Complete.	Summer 2010
7/15/2011	J. Larsen – Gull Point	Fence/Post	Move gate back to solve it being left open	Contact Judge Willmore to let him know of plan to move gate and change locks elsewhere.	Fall 2012
7/15/2011	T. Ballard	Fence/Post	Post broken and sprayed	Schedule onsite meeting with T. Ballard re: buffer post location and herbicide overspray during 2012 buffer monitoring	Talked with Todd spring 2013-Post fixed fall 2012
7/15/2011	T. Ballard	Encroachment	Spray drift with nonselective herbicide	See above	Talked with Todd Spring 2013

Appendix D-4. Property Coordination, Cutler Five-Year Report 2008-2012					
Date Encroachment Recorded	**Adjacent Landowner/Buffer Segment**	**Property Issue**	**Notes**	**Proposed Resolution**	**Completed/Date**
7/15/2011	Munk	Fence/Post	Need new buffer monitoring post	Verify location and replace	Summer 2012
7/15/2011	Munk	Encroachment	Check on lease or agreement	Verify easement/lease terms prior to buffer 2012	Summer 2012
7/15/2011	Munk	Trespass	Overspray on buffer with no selective herbicide	Based on above verification, schedule meeting with Munks to explain concern	Ongoing Resolution 4
7/15/2011	V. Rigby	Encroachment	Contact Rigby's about harvesting hay	Call Rigby to discuss concerns, especially with no lease	Replicate of #3
7/15/2011	Newton Substation	Trespass	Trespass - harvesting hay	Try and identify adjoiner responsible; discuss concerns, especially with no lease	Replicate of #1
7/15/2011	M. Rigby	Weeds		Prioritize this with surrounding parcel efforts	Summer 2012
7/15/2011	M. Rigby	Encroachment	Spraying and equipment	Contact USU farm to identify concern and request removal of stuff from the buffer	Spring 2012
7/15/2011	M. Rigby	Fence/Post	Need to check post data.	Verify post locations and replace if necessary	Complete fall 2012, only one post missing
7/15/2011	Roundy N	Encroachment	Contact Roundy with deadline to remove pipe.	Done	Summer 2012
7/15/2011	Roundy Big Bend	Fence/Post	Need monitoring post.	Replace	Summer 2011
7/15/2011	Roundy Big Bend	Fence/Post	Need to check posts.	Verify post locations and replace if necessary	Fall 2012
7/15/2011	Cowley	Weeds	Weeds are extensive in buffer. Need to address this fall	Prioritize this with surrounding parcel efforts	Spring 2012

Appendix D-4. Property Coordination, Cutler Five-Year Report 2008-2012					
Date Encroachment Recorded	**Adjacent Landowner/Buffer Segment**	**Property Issue**	**Notes**	**Proposed Resolution**	**Completed/Date**
7/15/2011	Roundy CRP	Weeds	Weeds in CRP*. Hemlock, Scotch thistle, bindweed, dyer's woad	Visit location with T. Walker--conduct weed clean-up	Spring 2013
7/15/2011	North Marsh West	Weeds	Weeds in CRP. Hemlock, dyer's woad	Visit location with T. Walker--conduct weed clean-up	Summer 2012
7/15/2011	North Marsh West	Fence/Post	Needs lock	Complete	Summer 2012
7/21/2011	M. Rigby	Weeds	Bad weeds	Confirm; Contact USU re: weed issues	Summer 2012
7/22/2011	H. Falslev Island	Fence/Post	Check post data replace monitoring post	Replace posts.	Started 2012/Ongoing 5
7/22/2011	L. Falslev	Fence/Post	Verify post data	Verify location; replace post; follow-up with L. Falslev once we have info.	Started 2012/Ongoing 6
7/22/2011	Rose Oxbow	Fence/Post	Replace monitoring t-post	Replace post	Completed 2012
7/22/2011	Rose Oxbow	Trespass	Grazing on PacifiCorp property	Contact adjoiners (S. Falslev) to discuss use of property	Ongoing Resolution 7
7/22/2011	Cardon South	Trespass	Trespass cows	More frequent drive-bys to ascertain	Summer of 2012 indicated adjoiner compliance
7/22/2011	Church Farm	Trespass	Trespass pivot and cows	Ongoing- Correspond with David Wright on latest offer to PacifiCorp	Fence fixed fall 2012
7/22/2011	B. Ballard North	Weeds	Dyers woad, bindweed	Prioritize this with surrounding parcel efforts	Summer 2012
7/22/2011	Griffin	Fence/Post	Replace monitoring t-post	Verify location and replace	Summer 2011

Appendix D-4. Property Coordination, Cutler Five-Year Report 2008-2012					
Date Encroachment Recorded	**Adjacent Landowner/Buffer Segment**	**Property Issue**	**Notes**	**Proposed Resolution**	**Completed/Date**
7/22/2011	Griffin	Trespass	Safflower planted on buffer	Start with letter to David Wright? advice on access, etc.	Ongoing Resolution 8
7/22/2011	Griffin	Encroachment	Cutting in buffer	Need to address on-going issue with possible fencing.	Replicate of 8
7/23/2011	Z.. Balls	Encroachment	Electric fence possible grazing	Check on ownership--send letter to address	Summer 2012
7/23/2011	Hobbs	Encroachment	Dumping, fill, and fence damage	Contact adjoiners to discuss use of property	Ongoing Resolution 9
7/23/2011	Gull Point	Fence/Post	Photopoint post missing	Replace post/completed	Summer 2012
7/23/2012	Glen Hobbs	Encroachment	Fence damaged	Schedule a fix.	Replicate of 9
9/23/2012	UDOT	Encroachment	staging on our property	Worked with UDOT and received reimbursement for reclamation of property. Complete.	Winter 2012
7/23/12	Griffin	Trespass	Continued planting in buffer	Send letter from attorney? Get advice on access for replanting, etc.	Replicate of 8
7/23/12	Church Farm	Trespass	Trespass pivot and cows	Ongoing- correspond with David Wright on latest offer to PacifiCorp	Replicate of 2
7/23/12	H. Falslev Island	Fence/Post	Check post data replace/replace monitoring post	Replace Posts	Replicate of 5
7/23/12	Lindley	Fence/Post	Trespass and missing posts	Replace posts and speak with neighbor landowner about trespass	Ongoing Resolution 10
*CRP = Conservation Reserve Program					

APPENDIX E

RECREATION SITE MONITORING

APPENDIX E-1: NON-ROUTINE RECREATION SITE MAINTENANCE

APPENDIX E-2: BOATER POLICY, REGULATIONS, AND SIGNS

APPENDIX E-3: SAMPLE TRAPPING PERMISSION LETTER

APPENDIX E-4: LOGAN RIVER RECREATION SITE PLAN AND CONSULTATION

APPENDIX E-5: FERC FORM 80 DATA

APPENDIX E-6: TEMPORARY SPECIAL USE PERMITS

APPENDIX E-1

NON-ROUTINE RECREATION SITE MAINTENANCE

APPENDIX E-1
NON-ROUTINE RECREATION SITE MAINTENANCE

1. **Little Bear River Rec Site:**
    - 2010 Gravel added to parking area
    - 2011, 2012 Bare ground vegetation treatment in parking area
2. **Little Bear Canoe Trail:**
    - 2008 Missing buoys replaced
3. **Logan River Canoe Trail:**
    - 2008 Missing buoys replaced
4. **Cutler Marsh Marina:**
    - 2010 Gravel added to parking lot
    - 2011 Graded
    - 2011, 2012 Bare ground vegetation treatment in parking area
5. **Wetland Maze Canoe Trail:**
    - 2008 Missing buoys replaced
6. **Railroad Walking Trail:**
    - 2008-2012 Weed and vegetation control
    - 2010 Mowing
    - 2012 Bare ground vegetation treatment testing
7. **Benson Marina:**
    - 2010 Gravel added to parking area
    - 2010 Cable fence around parking area repaired and posts replaced
    - 2011, 2012 Bare ground vegetation treatment in parking area
8. **Benson Walking Trail:**
    - No improvements necessary
9. **Upper Bear River Marina:**
    - 2010 Gravel added to parking area
    - 2011, 2012 Bare ground vegetation treatment in parking area
10. **Bear River Overlook:**
    - 2010 Gravel added to parking area
    - 2010 Installed portable toilet
    - 2011, 2012 Bare ground vegetation treatment in parking area
11. **Clay Slough Recreation Site:**
    - 2010 Gravel added to parking area
    - 2010 Sign maintenance
    - 2011, 2012 Bare ground vegetation treatment in parking area
12. **Cutler Canyon Marina:**
    - 2010 Gravel added to parking area
    - 2011, 2012 Bare ground vegetation treatment in parking area

13. **East Cutler Canyon Boat-In:**
    - 2011 Fire pits removed
14. **West Cutler Canyon Boat-In:**
    - 2011 Fire pits removed
15. **Logan River Recreation Site:**
    - 2010 Recreation site constructed
    - 2011 Recreation site opened
    - 2011, 2012 Bare ground vegetation treatment in parking area

APPENDIX E-2

BOATER POLICY, REGULATIONS, AND SIGNS

BOATER USE ZONE SIGN
(Posted at All Recreation Sites)

BOATER USE ZONES

The Cutler hydroelectric project consists of nearly 10,000 acres of land and water managed for power production, irrigation, public recreation, wildlife, and compatible agricultural uses. PacifiCorp recognizes and is committed to maintaining the unique recreation opportunities and wildlife habitat values provided by Cutler Reservoir.

To insure the enjoyment of the diverse users and protect the unique resource values of the area, PacifiCorp, Utah State Parks, and the Utah Division of Wildlife Resources are implementing the following watercraft use rules (see adjacent map):

North Boater Zone A (access via Benson or Canyon marinas**)**

In the area north of the Benson Railroad Bridge and west of the confluence with the Bear River:

- All motor sizes and safe speeds are allowed year round.

South Boater Zone B (access via Cutler Marsh or Benson marinas)

In the area south of the Benson Railroad Bridge:

- Motorized watercraft are restricted to a maximum of 35 horsepower motors and wakeless speeds year round.

Bear River Boater Zone C (access via Upper Bear River or Benson Marina)

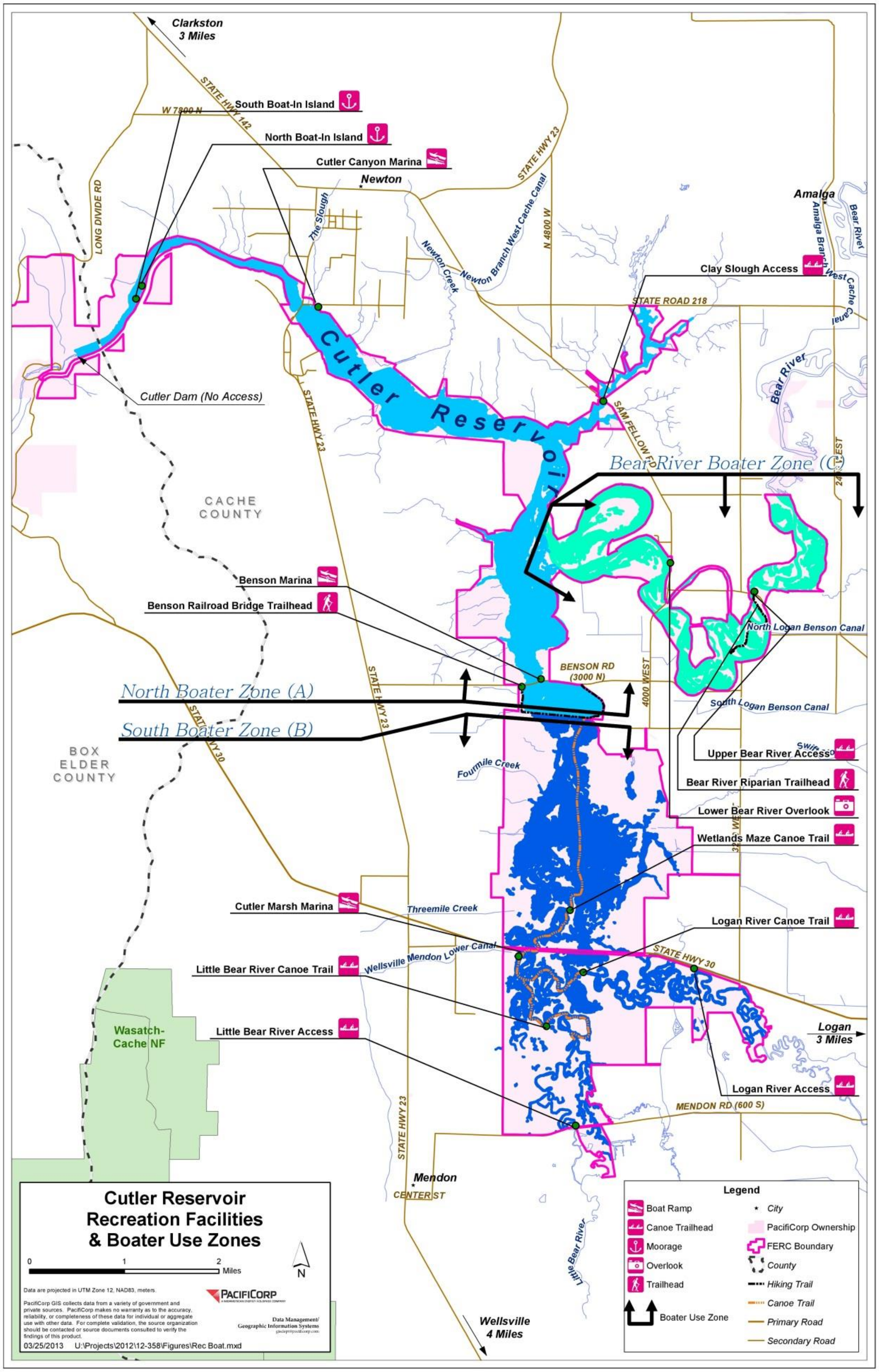
In the Bear River area, east of the confluence with Cutler Reservoir (including the 'horseshoe area'):

- Motorized watercraft are restricted to a maximum of 35 horsepower motors and wakeless speeds from the last Saturday in September to March 31 every year.

Boater use zones will be enforced. Please remember that you are entering a natural area where hazards exist….. *Your Safety is Your Responsibility.*

BOATER USE ZONE MAP

(Posted at all Recreation Sites)


Cutler Reservoir
Recreation Facilities
& Boater Use Zones
Clarkston 3 Miles
South Boat-In Island
North Boat-In Island
Cutler Canyon Marina
Newton
Amalga
Clay Slough Access
Cutler Dam (No Access)
Cutler Reservoir
Bear River Boater Zone (C)
CACHE COUNTY
Benson Marina
Benson Railroad Bridge Trailhead
BENSON RD (3000 N)
North Boater Zone (A)
South Boater Zone (B)
BOX ELDER COUNTY
Upper Bear River Access
Bear River Riparian Trailhead
Lower Bear River Overlook
Wetlands Maze Canoe Trail
Cutler Marsh Marina
Logan River Canoe Trail
Little Bear River Canoe Trail
Little Bear River Access
Logan 3 Miles
Logan River Access
Wasatch-Cache NF
MENDON RD (600 S)
Mendon
Wellsville 4 Miles
Legend
Boat Ramp
Canoe Trailhead
Moorage
Overlook
Trailhead
Boater Use Zone
City
PacifiCorp Ownership
FERC Boundary
County
Hiking Trail
Canoe Trail
Primary Road
Secondary Road
Miles
Data are projected in UTM Zone 12, NAD83, meters.
PACIFICORP
03/25/2013 U:\Projects\2012\12-358\Figures\Rec Boat.mxd

STATE BOATER REGULATION
Effective March 2008

STATE BOATER REGULATION FOR CUTLER RESERVOIR
Effective March 2008

R651-205-17. Cutler Reservoir. The use of motors whose manufactured listed horsepower is more than 35 horsepower is prohibited and a vessel may not be operated at a speed greater than wakeless speed at any time in the area south of the Benson Railroad Bridge. A vessel may not be operated at a speed greater than wakeless speed from the last Saturday in September through March 31^{st} in the Bear River, east of the confluence with the reservoir.

APPENDIX E-3

SAMPLE TRAPPING PERMISSION LETTER

PACIFICORP ENERGY
A DIVISION OF PACIFICORP

825 NE Multnomah, Suite 1500
Portland, Oregon 97232

October 26, 2012

Via First Class Mail and electronic mail

[PERMITTEE'S NAME AND ADDRESS; PHONE; EMAIL]

RE: Limited Permission to Trap in Cutler Marsh until 15 February 2013

Dear [permittee's name]:

This letter authorizes [permittee's name] (Utah Trap Registration # ________) to trap in the manner provided in this letter on certain areas of Cutler Marsh owned by PacifiCorp, excluding all PacifiCorp lands within a quarter-mile of any developed recreation site (i.e., the Little Bear River, Logan River, Cutler Marsh (Valley View), Benson, Upper Bear River, Bear River Overlook, Clay Slough, or Cutler Canyon recreation sites). Permission to trap granted by this letter is effective from the date of this letter until 15 February 2013. **All trapping must be in accordance with the following safety rules**:

- Above Water Trapping
  - Only live traps may be used above water.
  - "Live trap" means a cage trap that contains, but does not harm in any manner, any animal trapped within it.
  - "Above water" means all portions of the trap, including any stake or chain, must be completely above the water line and no portion of the trap or stake may come in contact with water.
  - The earliest live traps may be set or placed is one hour before official sunset.
  - All live traps must be emptied or removed no later than one hour after official sunrise.
  - Live traps may not be used when nighttime low temperatures are predicted to fall below 10 degrees Fahrenheit.
  - "Sunset" and "sunrise" shall have the meaning found in Utah wildlife regulations (the "Proclamation").

- Below Water Trapping
  - All traps other than live traps, including snares, may only be used below water.
  - "Below water" means all portions of the trap, including the stake and/or chain or other means of securing the trap or snare, must be completely under the water's surface, although it is permissible for the tops of the stakes to be visible above the water's surface in order to locate the traps. The water depth where the traps or snares are located must be sufficient such that no terrestrial animals would become trapped or ensnared; i.e., shallow water areas or shoreline edges are not permissible.

- In addition to these Cutler Marsh safety rules, all trapping must be in accordance with Utah wildlife laws and all other applicable federal, state, and local laws.

Failure to abide by the above safety rules will result in revocation of this permission to trap. PacifiCorp further reserves the right to revoke permission to trap at any time, and at PacifiCorp's complete and sole discretion, by providing notice by phone, mail, any other contact information listed in this letter, in person, signage posted at Cutler Marsh, or any other means reasonably likely to apprise you of revocation.

With respect to the general public's use of Cutler Marsh, including your use as permitted by this letter, PacifiCorp reserves all protections from liability afforded to a landowner who allows the public to make recreational use of land, including all protections under Utah's Limitation of Landowner Liability Act (Utah Code §§ 57-14-1 to 57-14-7). PacifiCorp intends this permission letter to serve as permission under Utah Code § 57-14-4(1). PacifiCorp has not charged you or any member of the public any fee to use Cutler Marsh for trapping or any other recreational purpose.

PacifiCorp's Cutler Marsh is generally open free of charge for recreational use by all members of the public. PacifiCorp has posted the property with signs stating "no trapping without written authorization" for the sole purpose of allowing PacifiCorp to impose reasonable safety restrictions on the type of recreational trapping allowed in Cutler Marsh. Consistent with the Limitation of Landowner Liability Act, during times when PacifiCorp allows trapping in Cutler Marsh, PacifiCorp will issue written permission to trap without charge to any member of the public requesting permission to trap. .No trapping is allowed in Cutler Marsh by any person who has not previously obtained PacifiCorp's written permission to trap subject to the above safety restrictions.

PacifiCorp reserves the right to modify its restrictions on trapping at Cutler Marsh at any time, including the right to completely ban trapping. PacifiCorp has no obligation to renew your permission to trap in Cutler Marsh. This permission letter does not apply to any person other than the named recipient.

If you have any question please contact me at 801-220-2245.

Sincerely,

Eve Davies, Principal Scientist
PacifiCorp Energy
1407 West North Temple, Suite 110
Salt Lake City, UT 84116
801-220-2245
801-232-1704 (cell)
Eve.davies@pacificorp.com

APPENDIX E-4

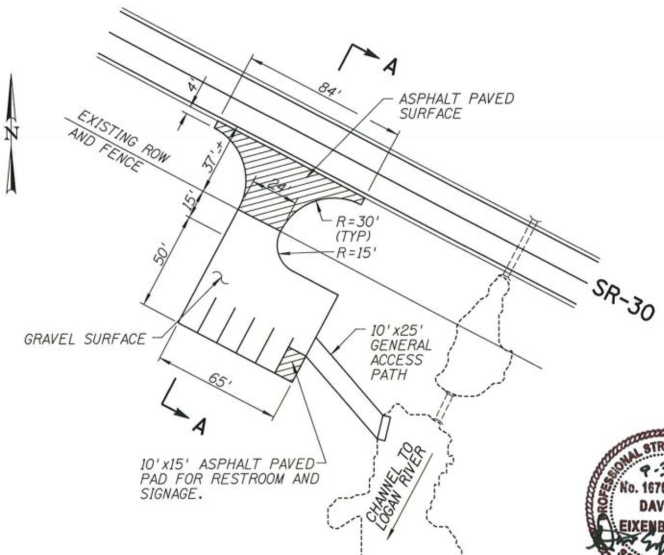
LOGAN RIVER RECREATION SITE PLAN AND CONSULTATION

State Route 30 Logan, Utah
Logan River Parking Facility

PROFESSIONAL STRUCTURAL ENGINEER
9-3-10
No. 167872-2203
DAVID M
EIXENBERGER
STATE OF UTAH

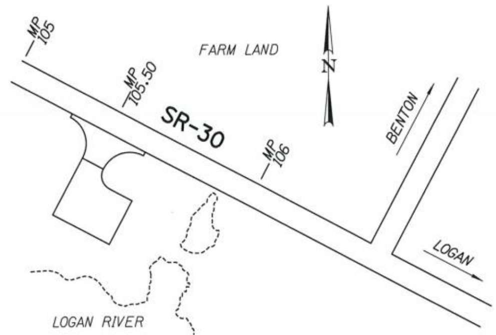
T·Y·LIN INTERNATIONAL
engineers | planners | scientists

PACIFIC CORP.
Logan River Parking Facility
Situation and Layout
Sheet 1 of 2



PLAN VIEW

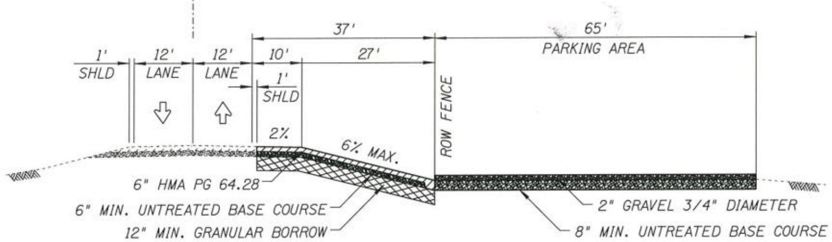
NOT TO SCALE



LOCATION VIEW

NOT TO SCALE

PROFESSIONAL STRUCTURAL ENGINEER
No. 167672-2203
DAVID M EIXENBERGER
STATE OF UTAH



CROSS SECTION A-A

NOT TO SCALE

TYLIN INTERNATIONAL
engineers | planners | scientists

GENERAL NOTES

1. Unless specified otherwise, all roadway materials shall conform to the current edition of the Utah Department of Transportation Standard Specifications for Road and Bridge Constructions.

2. Any Special Provision or supplemental specifications supersede the Standard Specifications.

3. The approach roadway between the existing State Road (SR-30) and the right of way fence (approximately 37 feet) shall be paved with a minimum of 4 inches of Hot Mix Asphalt conforming to Performance Grade PG 64-28 and UDOT Standard Specification 02741.

4. The approach roadway between the existing State Road (SR-30) and the right of way fence shall have a minimum of 4 inches of Untreated Base Course material conforming to UDOT Standard Specification 02721.

5. Any disturbed or damage Right of Way fencing along the State Road (SR-30) shall be repaired or replaced conforming to UDOT Standard Specifications.

6. All materials on the Pacificorp private property and beyond the UDOT right of way line are not required to meet the UDOT specifications but shall meet other requirements of the plans, specifications and estimates.

7. Contractor shall sawcut SR-30 pavement to create a straight match line with the approach roadway pavement.

8. Asphalt pavement may be used for parking surface at the owner's discretion.

REVISIONS

PACIFICORP
SALT LAKE CITY, UTAH
HYDRO POWER DIVISION

DESIGN D.E. 4/10 CHECK D.A. 4/10
DRAWN D.R. 4/10 CHECK D.A. 4/10
QUANT. D.E. 4/10 CHECK D.A. 4/10

LOGAN RIVER
PARKING FACILITY
SITE PLAN

PROJECT NUMBER

CACHE
COUNTY
X-###
DWG. NO.
SHT. 1 OF 1

State of Utah

GARY R. HERBERT
Governor

GREG BELL
Lieutenant Governor

DEPARTMENT OF TRANSPORTATION

JOHN R. NJORD, P.E.
Executive Director

CARLOS M. BRACERAS, P.E.
Deputy Director

June 8, 2010

David Eixenberger, P.E., S.E.
T·Y·LIN International
6465 S. 3000 E., Suite 105
Salt Lake City, UT 84121

RE: **SR-30, Existing Access to PacifiCorp Property near Logan City**
ID# 10-028

Dear Mr. Eixenberger:

The UDOT Region One Engineering staff has reviewed and **conditionally approved** the request for an access of **SR-30, Existing Access to PacifiCorp Property near Logan City.** At this time the following items need to be addressed:

1. Show on plan set pavement cross section of 6" PG grade hot mix asphalt, 6" untreated base coarse, & 12" granular barrow, or submit your own pavement cross section with design calculations and show on plan set.

2. Call out sawcut line at shoulder line.

If you have any further questions or concerns, please contact me at 801-620-1604.

Sincerely,

Tommy H. Vigil
Region Right of Way Control Coordinator

THV/kn

cc: Jason Davis, P.E.
Brad Humphreys, P.E.
Darin Duersch, P.E.
Kelly Barrett, P.E.
Frank May
Jeff Gilbert, CMPO

Region One Headquarters • 169 West Southwell Street • Ogden, Utah 84404
telephone (801) 620-1600 • facsimile (801) 620-1605 • www.udot.utah.gov

From: Jay Baker [mailto:Jay.Baker@cachecounty.org]
Sent: Monday, August 23, 2010 10:23 AM
To: Conder, Claudia
Subject: Re: PacifiCorp permit- Logan River rec site-Valley View Hwy

Claudia:

The Zoning Clearance is complete for your recreation facility. Since you and Eve Davies are listed as the agents one of you two need to pick up the permit and sign for it. The fee is $50.00. Thank you for your patience.

Jay Baker
Cache Countywide Planner
179 North Main, Suite 305
Logan, UT 84321
435-755-1640

APPENDIX E-5

FERC FORM 80 DATA

Federal Energy Regulatory Commission (FERC)
FERC Form 80

Licensed Hydropower Development Recreation Report

Form Approved
OMB No. 1902-0106
Expires: 09/30/2010
Burden 3.0 hours

This form collects data on recreational resources at projects licensed by the Federal Energy Regulatory Commission under the Federal Power Act (16 USC 791a-825r). This form must be submitted by licensees of all projects except those specifically exempted under 18 CFR 8.11 (c). Submit this form on or before April 1, 2009. Submit subsequent filings of this form on or before April 1, every 6th year thereafter (for example, 2015, 2021, etc.). Submit an original and two copies of the form to the Commission's Regional Office (specified in the cover letter to this form). The public burden estimated for this form is three hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing the collection of information. Please send your comments about this burden estimate, or any other aspect of this collection of information, including suggestions to reduce the burden, to: Director, Division of Hydropower Administration and Compliance, Federal Energy Regulatory Commission, 888 First Street NE, Washington, D.C. 20426 and the Office of Information and Regulatory Affairs, Desk Officer-FERC, Office of Management and Budget, Washington, D.C. 20503.

Failure to comply with this collection of information will not result in a penalty, if you were unaware that a valid control number assigned by the Office of Management and Budget must be displayed on this collection of information.

Instructions:

a. All data reported on this form must represent recreational facilities and services located within the development/project boundary.
b. To ensure a common understanding of terms, please refer to the Glossary on page 3.
c. Report actual data for each item. If actual data are unavailable, then please estimate.

Schedule 1. General Information

1. Licensee Name: PacifiCorp	8. Reservoir Surface Area at Normal Pool (acres): 6,000
2. Project Name: Cutler	9. Shoreline Miles at Normal Pool: 32
3. Project Number: 2420	10. Percent of Shoreline Safely Accessible to the General Public by Land Travel without Trespassing: 5%
4. Development Name: Cutler	
States Development/Project Traverses (List state with largest area within the development/project boundary first): 5. State #1: Utah 6. State #2: ____ 7. Type of Project License: (check one) Major ☐ Minor ☐	11. Data Collection Methods (enter percent for each method used; total must equal 100%): 100% traffic count/trail count ____ attendance records ____ staff observation ____ visitor assessment ____ estimate

For the previous calendar year, enter only the licensee's annual recreational construction, operation, and maintenance costs for the development (project). Also, enter the corresponding annual recreational revenues.

Item	Licensee's Annual Recreation Costs and Revenues (In Whole Dollars)	
	Construction, Operation and Maintenance Costs	Recreation Revenues for Calendar Year
12. Dollar Values	75,600	-0-

13. Length of Recreation Season
Summer: From (MM/DD) 05/23 To 09/01 Winter: From (MM/DD) 09/02 To 05/22

Period	Number of visits to all recreational areas at development/project (in Recreation Days)	
	Annual Total	Peak Weekend Average
14. Daytime	87,450	1010
15. Nighttime	-0-	-0-

Respondent Certification: The undersigned certifies that he/she examined this report; and to the best of his/her knowledge, all data provided herein are true, complete, and accurate.

Mark Stenberg	Program Manager	208 852.5507
Legal Name	Title	Area Code/Phone No.
[signature]	03/20/2009	3/1/2009
Signature	Date Signed	Reporting Year Ending

Title 18 U.S.C.1001 makes it a crime for any person knowingly and willingly to make to any Agency or department of the United States any false, fictitious or fraudulent statement or misrepresentation as to any matter within its jurisdiction.

Federal Energy Regulatory Commission (FERC)
FERC Form 80

Licensed Hydropower Development
Recreation Report

Schedule 2. Inventory of Recreational Resources

16. Enter data for each Recreational Resource Type (a). For Facility Capacity (f), of total available resources (b) + (c), compare the average total amount of weekend use (during the recreation season reported on Schedule 1, Item 13) with the total combined capacity of these resources to handle such use and enter a percentage that indicates their overall level of use. Do not consider peak weekend use (see Glossary). For example, if all available Boat Ramps are used to half capacity during non-peak weekend days, enter 50%. For all available Boat Ramps that are used beyond their combined capacity, enter the appropriate percentage above 100.

Recreational Resource Type (a)	No. of Available Resources: User Free (b)	User Fee (c)	No. FERC Approved Resources (d)	Total Miles/Acres (e)	Facility Capacity (percent) (f)
Access Areas. (No Facilities). Unimproved but well-known/popular sites which can be used to reach development/project waters (including waters below a dam) without trespassing on other property. Such areas can be used for launching boats, fishing, swimming, or other water recreational purposes.	4			N/A	
Boat Launch Areas. Improved areas having one or more boat launching lanes and (a) are usually marked with signs, (b) have compacted gravel or concrete surfaces, and (c) usually have adjacent parking lots.	6			N/A	
Boat Launch Lanes. The number of lanes are determined by the total number of boats that can be launched easily at the designated boat launch areas at one time.	4			N/A	
Marinas. Public and Private facilities on or adjacent to the development/project waters for the docking, fueling, repair and storage of boats, and which may rent boats and equipment, or sell bait or food.				Acres	
White Water Boating. Access areas below a dam that can be used for rafting/kayaking.				N/A	
Canoe Portages. Site located above and below a dam, diversion, or other obstruction where persons can launch and take out canoes; and the improved, designated, and maintained trails connecting such sites.				Miles	
Tailwater Fishing Facilities. Platforms, walkways, or similar structures to facilitate below-dam fishing.				N/A	
Fishing Piers. Structures which are installed and maintained in development/project waters specifically for fishing. This code excludes tailwater fishing facilities.	1			N/A	
Parks. Designated areas which usually contain multiple use facilities (e.g., picnic sites, playgrounds, swimming beaches, and boat ramps). Individual facilities within each park should be reported under the appropriate resource type (e.g. playground areas, picnic areas, etc.)	2			Acres 6	
Playground Areas. Have playground equipment, game courts/fields, jogging tracks, etc.				Acres	
Trails. Improved pathways used for non-automobile recreational travel which (a) can be located on a reference map, and (b) are designated according to type of use (hiking, bridle, trail bikes, snow mobiles, cross-country skiing). This category excludes canoe portages.	2			Miles 4	
Swimming Areas. Sites providing access to development/project waters where swimming facilities (bath houses, designated swim areas, parking, and sanitation facilities) are available.				Acres	
Picnic Areas. Areas designated and maintained for picnicking and which contain one or more picnic sites, each of which includes a picnic table and in some cases cooking grills, trash receptacles, and a parking area.	4			8 Acres	
Wildlife Areas. Natural areas and reserves specifically created and managed for the protection and propagation of wildlife and the viewing of wildlife in their natural habitat.	1			Acres 10,000	
Visitor Centers. Facilities located in a kiosk, pavilion or similar structure from which persons may obtain information about the development/project, its operation, recreational facilities, and related items of interest.				N/A	
Interpretive Displays. Facilities (exhibits and museums) which describe or explain archaeological, historic, or prehistoric objects, structures, sites, areas, activities, artifacts, and materials.				N/A	
Overlooks. Public areas to view natural areas/project features (e.g., pull-offs or vistas).	1			.25 Acres	
Hunting Areas. Public or private areas open to the general public for hunting.	1			9,800 Acres	
Golf Courses. All types of golf areas, except miniature golf.				Acres	
Cottage/Cabin Sites. Recreational dwellings which are seasonally rented by the public for recreational purposes.				N/A	
Camping Areas/(Campgrounds). Areas containing two or more campsites, tent sites, or trailer/recreational vehicle (RV) sites which accommodate overnight camping. This category does not include group camps.				Acres	
Tent/Trailer/RV Sites. The total number of sites within Camping Areas that have been specifically developed for tent, trailer, or RV use. This category does not include sites within group camps.				Acres	
Organizational Camps. Camping areas that are maintained and operated by a specific entity but which may be used by other persons or groups (scout camps, military base recreation camps, church camps, handicapped children camps).				Acres	
Group Camps. Camping areas which are equipped with facilities to accommodate use by the general public. These areas usually require registration or advance reservation.				Acres	
Winter Sports. Any facility or site providing sports like skiing, sledding, ice skating, or ice fishing.	1			N/A	
Other - such as informal/dispersed camping areas, unimproved trails, etc. (specify): canoe trails	3			N/A	

Actual Car Counter Data Summaries by Season

Cutler	weekday	weekend	totals
Spring	9645	6131	15776
Summer A	5669	3475	9144
Summer B	7556	5042	12598
Summer C	8109	3000	11109
Fall	12440	3996	16435
Winter A	8404	2669	11073
Winter B	8779	2535	11315
	60602	26848	87450

APPENDIX E-6

TEMPORARY SPECIAL USE PERMITS

Table E-6-1. Temporary Special Use Permits Granted by PacifiCorp during the Cutler RMP Five-Year Monitoring Period, 2008-2012 (program initiated in late 2010).		
Lessee	**Purpose**	**Dates**
Ron Stagg	Eagle Scout projects (2x)	May-August 2010
Verein Deutsch Drahthaar - Group North America	Dog trials	Sept 16-18, 2011
Utah Bowfishing Association	Carp thinning in reservoir	3 days, 2012
Utah State University	Camping sites	3 days, 2012
Utah State University	Minnow trapping	Aug 27 to Dec 31, 2012
Wes Thompson	Boy scout project to clean	3 days, 2012
Utah State University Biology Dept	crayfish collecting	Nov 15 to Dec 31, 2012

APPENDIX F

FISHERIES DATA

APPENDIX F-1: EXECUTIVE SUMMARIES OF WURTSBAUGH/USU LIMNOLOGY CLASS PAPERS ON CUTLER RESERVOIR

APPENDIX F-2: BUDY UNPUBLISHED DATA--USU FISHERIES CLASS NOTES AND CUTLER FISH SAMPLING DATA

APPENDIX F-1
EXECUTIVE SUMMARIES OF WURTSBAUGH/USU LIMNOLOGY CLASS PAPERS ON CUTLER RESERVOIR

Comparison of Limnological Characteristics in Cutler Reservoir (Utah) near the Inflows of the Logan River and the Logan Wastewater Treatment Plant

Aquatic Ecology Practicum Class Report
Department of Watershed Sciences
College of Natural Resources
Utah State University

December, 2007

Marshall Baillie
Chad Low
Travis Dees
Kurt Jensen
Jacob Stoller
Robert Reilly

Editors
Wayne A. Wurtsbaugh and Ryan Lockwood
wurts@cc.usu.edu; tradryan@gmail.com

Table of Contents

Suggested Citation for entire report:

Wurtsbaugh, W.A. and R. Lockwood (editors) 2007. Comparison of Limnological Characteristics in Cutler Reservoir (Utah) near the Inflows of the Logan River and the Logan Wastewater Treatment Plant. Aquatic Ecology Practicum Class Report, College of Natural Resources, Utah State University. 100 p.

Acknowledgements

We would like to thank Mike Allred of the Utah Division of Water Quality and Erica Gaddis of SWCA for their support and for providing access to documents on the Cutler TMDL. The laboratory of Phaedra Budy and especially Peter MacKinnon, Kirk Dahle and Gary Thiede helped provide logistical support, and other information on the reservoir. Eve Davies and Beth Neilson provided maps on the reservoir and its inflows. We especially want to thank Chris Luecke for his continued support of the class that makes these student projects possible.

Summary

Cutler Reservoir, located near Logan, Utah was constructed in 1927 and impounds the waters of the Bear, Little Bear, Cub, Logan and Blacksmith Fork Rivers, as well as Spring Creek and many other small tributaries. This impoundment has created a reservoir and associated wetlands of over 4,000 hectares, and its main purpose is to provide water for irrigation, but also produces some hydropower (Budy et al., 2007). The reservoir is in Cache Valley, which has large amounts of agricultural land use as well as urban development. Water quality is of concern in Cutler which is listed under Utah's 303(d) list of impaired waters, and has a pending total maximum daily load (TMDL) assessment with respect to phosphorus inputs. The reservoir also receives effluent from Logan's Wastewater Treatment Plant, which handles the sewage from 70% of the valley's population. The reservoir and associated wetlands are also used extensively for recreation by hunters, fisherman, water skiers and boaters, as well as bird watchers. To contribute to the assessment of water quality and limnological conditions in this wetland reservoir, the Utah State University's Watershed Sciences' Aquatic Ecology Practicum class studied Cutler Reservoir in September 2007. Each student conducted an independent analysis, and these are assembled here to address some of the important issues facing water quality managers.

Much of the student work focused on two transects: one in the northern part of Cutler Reservoir near the discharge of the Logan Wastewater Treatment Plant (WWTP), and a "control" site along the lower Logan River and southern part of the Cutler wetland complex. Five stations were sampled in each of these regions. Station depths varied from 0.15 to 2.05 m (see Ch. by Low, Table 1). During the September 27th sampling, however, there were negligible discharges into Cutler from the Wastewater Treatment Plant, and the lower part of the Logan River likely had polluted water entering it from a canal connected to heavily-contaminated Spring Creek. The summary data from these transects is shown in Figure 1.

Marshall Baillie measured total phosphorus, phytoplankton chlorophyll, and optical brighteners (a measure of wastewater treatment plant discharge) at 20 sites in Cutler Reservoir and its tributaries. Total phosphorus concentrations ranged from 1 µg/L at the mouth of the Logan River Canyon above the city of Logan, to 536 µg/L in Cutler Reservoir near the discharge of the Logan Wastewater Treatment Plant. Optical brighteners and TP were 230% and 1190% higher near the WWTP than in the Logan River (Fig. 1). A significant positive relationship was found between optical brighteners (OB) and total phosphorous concentrations. Mean chlorophyll levels were much less than predicted based on the very high TP measurements, perhaps because of light or nitrogen limitation. Mean chlorophyll levels were 24 µg/L, but the data did not show clear spatial patterning across the watershed, perhaps because of some technical difficulties in measuring this parameter. These data demonstrate the very large increase in nutrient levels due to point and non-point source pollution.

The class deployed three water quality sondes three days prior to the September sampling to assess diel cycles in oxygen, temperature and pH. Temperatures ranged from a low of 8°C at night to 19°C at one of the sites near the Wastewater Treatment Plant discharge. Oxygen variations were high, particularly in the North Cutler sites near the Wastewater Treatment Plant. Oxygen levels there decreased to < 3 mg/L, whereas in the Logan Rive they were above 9 mg/L. However, a comparison of the Cutler

Reservoir oxygen concentrations with non-polluted wetlands suggests that the low nighttime oxygen levels may not necessarily be a consequence of eutrophication.

Robert Reilly analyzed chlorophyll and organic mater content in the benthic zone along the Logan River and Wastewater Treatment Plant transects. Generally, benthic chlorophyll levels were higher along the Logan transect (mean, 138 mg/m^2) than along the WWTP transect (mean, 14 mg/ m^2; Fig. 1). Turbidities were high and light extinction was high at most sites. A regression analysis showed that benthic chlorophyll concentrations decreased significantly with decreased light levels reaching the bottom, suggesting that high turbidity in the river and reservoir may limit benthic chlorophyll levels. Mean ash free dry mass varied from 0.6 to 1.8 g/m^2 at different sites The AFDM in both transects varied with distance away from the input sites, but neither trend was significant.

Zooplankton species composition, abundance and biomass were analyzed by Chad Low. Total zooplankton biomasses were 19 µg/L at the Logan transect and only 3 µg/L at the WWTP transect (Fig. 1). The densities and biomasses in Cutler Reservoir in autumn 2007 were very low compared to those reported from other studies of zooplankton in wetlands, and 10 to 100 times lower than would be predicted based on total phosphorus concentrations. The sizes of zooplankton found were also small compared to those found in natural lakes with balanced fish community, indicative of high predation by a stunted fish population. The reasons for the small zooplankton size structure and low biomass are not clear.

Jacob Stoller and Travis Dees analyzed the benthic invertebrate communities in the soft substrates along the two transects. These habitats were dominated by gnat larvae (chironomids) and oligochaet worms. The oxygen-resistant oligochaets were abundant near the WWTP discharge, and there was greater invertebrate diversity (albeit limited) in the lower Logan River. The invertebrate biomass data indicated no significant difference along gradients, but a significant difference did occur between the two transects. The Logan River had an average biomass of 140 mg/m^2 and the WWTP transect had an average biomass of only 32 mg/m^2 (Fig. 1). Benthic invertebrate biomasses in the soft sediments near the WWTP were among the lowest reported in any lake in the world. More work on benthic invertebrate abundances and distribution are needed in other microhabitats and during different seasons.

Kirt Jensen conducted a laboratory experiment to determine whether barley straw is an effective algaecide when used on Cutler Reservoir water. Water from both the Logan River transect and from the Logan Wastewater Treatment Plant transect were mixed with barley straw in 7-L aquaria and chlorophyll levels measured periodically fro 35 days and compared with controls without straw. The phytoplankton chlorophyll concentrations measured at approximately 5-day intervals indicated that there was no significant effect of the barley straw on either water source, but there was a suggestion that the barley was beginning to have an effect in the in the Logan River water at the end of the 35-day experiment. A longer field experiment would be needed to definitively say that the straw has no influence on phytoplankton production.

Wayne Wurtsbaugh conducted a demonstration nutrient addition bioassay in the laboratory to assess whether the phytoplankton in the two regions of Cutler Reservoir were limited by nitrogen or phosphorus during the fall. Phytoplankton at the north Cutler site near the WWTP were initially (day 4) limited by nitrogen, with chlorophyll levels in these treatments reaching 440 µg/L. Measured total phosphorus levels at this site (0.54 mg/L) were clearly high enough to support exceedingly high algal growth when nitrogen was added. At the south Cutler site, phytoplankton were initially co-limited by nitrogen and phosphorus. However, after 20 days, phosphorus additions alone stimulated nitrogen-fixing cyanobacteria, and these cultures had the highest chlorophyll levels of any of the treatments. The bioassays suggest that both nitrogen and phosphorus can be limiting phytoplankton growth in Cutler Reservoir at any one time, but that the existing nutrient levels are sufficient to support very high phytoplankton production.

The combined data show that Cutler Reservoir is very productive with high nutrient levels and moderately low nighttime oxygen levels, but it is not clear if this is due to eutrophication or natural processes that occur in shallow wetlands. It is likely that nitrogen levels, phosphorus and light penetration all help control phytoplankton densities in the reservoir. Barley straw additions are unlikely to provide remediation for high chlorophyll levels. Biomasses of both zooplankton in the water column and benthic invertebrates in the soft sediments were extremely low, and significantly lower near the wastewater discharge area. All of the results and conclusions, however, must be reviewed cautiously, as the field work was conducted on a single day and most of the analytical methods were new to students, and thus subject to errors. Nevertheless, the combined results provide a good overview of conditions and interactions among many different trophic levels in the reservoir, and thus may be useful in guiding future studies.

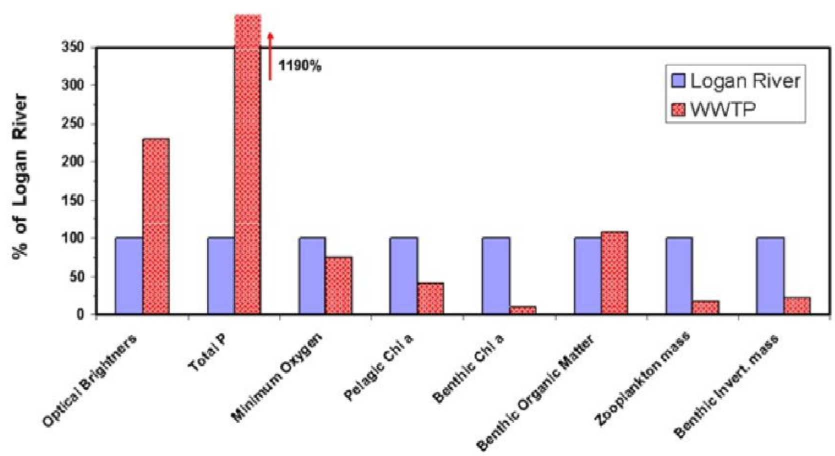


Figure 1. Summary comparison of limnological parameters measured in 3-5 locations along a transect in the lower Logan River/Cutler wetlands, and in a transect near the discharge of the Logan Wastewater Treatment Plant (WWTP). A lower minimum oxygen level was recorded in the WWTP area, but the probe may have not been functioning properly and the data are not incorporated in this figure. Replicate pelagic chlorophyll measurements were highly variable, suggesting some methodological problem in measuring this parameter.

2008 Project Report

Comparative Limnological Analysis of Cutler Reservoir and Dingle Marsh with Respect to Eutrophication

Aquatic Ecology Practicum (WATS 4510) Class Report
Watershed Sciences Department
College of Natural Resources
Utah State University
Logan, UT 84322-5210

Students
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Paul Mason, Jared Randal
David Epstein (TA)

Edited by
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February 17, 2009

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Comparative Limnological Analysis of Cutler Reservoir and Dingle Marsh with Respect to Eutrophication

Limnological Team (from left): Justin Elsner, Ben Abbott, Paul Mason, Dave Epstein, Nic Braithwaite, Wayne Wurtsbaugh and Jared Randal.

Acknowledgements

We would like to thank Mike Allred of the Utah Division of Water Quality and Erica Gaddis of SWCA for their support and for providing access to documents on the Cutler TMDL. Phaedra Budy and especially Peter MacKinnon and Gary Thiede helped provide logistical support. Ian Washbourne and staff at the DWQ helped analyze nutrient samples. James Harps from the Logan Environmental Department provided data and access to the city's treatment wetlands. Annette de Knijf from the US Fish and Wildlife Service facilitated our work in Dingle Marsh. We especially want to thank Department Head Chris Luecke for his continued support of the class that makes these student projects possible.

Executive Summary

Cutler Reservoir, located near Logan, Utah impounds the Bear, Little Bear, Cub, Logan and Blacksmith Fork Rivers, as well as Spring Creek and many other small tributaries. This impoundment has created a reservoir and associated wetlands of over 40 square kilometers, and its main purposes are to provide water for irrigation and hydropower. It is also an important water body for recreation and provides wildlife habitat for birds and mammals. The reservoir is in the Cache Valley, which supports large amounts of agriculture and urban development that cause non-point source pollution. The reservoir also receives effluent from Logan's Wastewater Treatment Plant (WWTP), which handles sewage from 70% of the valley's population of near 110,000. Cutler is listed under Utah's 303(d) list of impaired waters, and it has a pending total maximum daily load (TMDL) assessment with respect to phosphorus inputs and oxygen levels.

To help understand eutrophication in Cutler Reservoir we compared some of its limnological characteristics to those of Dingle Marsh (Idaho). Dingle Marsh, lying on the northern edge of Bear Lake (UT/ID) also receives the majority of its water and nutrient loading from the Bear River. However, being higher in the watershed, anthropogenic nutrient loading is reduced relative to that in Cutler Reservoir, and it thus serves as a relatively unimpacted control ecosystem. The analyses were done by undergraduate students in Utah State University's Watershed Sciences' Aquatic Ecology Practicum class (WATS 4510). Students conducted independent analysis, and these are assembled here to address some of the important issues facing water quality managers. Most of the field sampling was done from September 23-26th, 2008, and thus was a narrow time window for assessing ecosystem processes. Nevertheless, this is a time of year when north-temperate lakes may suffer the most significant degradation. The majority of the sampling in Cutler Reservoir was done within 2.8 km of the discharge point of the Logan City Wastewater Treatment Plant. Consequently, many of the results are representative of this most-impacted region of the reservoir, and not necessarily for other sections. The sampling in Dingle Marsh was primarily in Mud Lake, a system morphologically very similar to the dominant shallow wetlands in Cutler Reservoir (Figure 1).

Table 1. Summary of trophic parameters at sites in Mud Lake at Dingle Marsh, or in Cutler Reservoir at sites within within 2.8 km of the Logan Wastewater Treatment Plant discharge point. September 2008. Note that other analyses in the report cover stations outside of Mud Lake and more distant from the WWTP discharge point.

Parameter	Dingle	Cutler
Trophic State Indices		
Total P (mg/L)	0.05	0.82
Total N (mg/L)	0.53	1.27
Pelagic Chl *a* (ug/L)	2.2	18.6
Secchi Depth (m)	0.49	0.24
Oxygen Cycling		
Minimum Oxygen (mg/L)	6	3.3
BOD (mg/L)	0.44	3.91
SOD (mg O2/m2/h)	8.2	10.1
Nutrient cycling		
P release (mg P m^{-2} day^{-1})	-2	89.4
δ15N	4.8	10.4
Nutrient Limitation (% of Control: Day 8)		
Redfield Ratio (mass)	10.3	1.5
Response to P	75	93
Response to N	234	478
Response to NP	8176	420

Many of the results are summarized in Table 1. Nicolas Braithwaite compared the trophic state in the two wetlands by measuring total phosphorus (TP), chlorophyll *a* and Secchi depth transparencies. The TP and chlorophyll concentrations were over 10 times higher in Cutler Reservoir than in Mud Lake, and Secchi depths in Cutler were about one-half of those in Dingle


Figure 1. Left–Sampling invertebrates in Mud Lake, Idaho. Right–Invertebrate and periphyton sampling in Cutler Reservoir, 25 September 2008. Note similar characteristics of the two ecosystems.

Marsh (Mud Lake). The mean chlorophyll *a* level in Cutler was 18.6 *ug*/L compared to 2.2 *ug*/L in Mud Lake. Total phosphorus was elevated at all sites sampled within Cutler Reservoir but was not accompanied by proportionally-elevated levels of chlorophyll. In Cutler Reservoir, mean Trophic State Indices for total phosphorus (98) and Secchi depths (78) were much higher than for chlorophyll (60). This suggests that algal production in Cutler may currently be limited by light levels and/or another nutrient. The comparative analysis of the two ecosystems indicates that Cutler Reservoir is much more eutrophic than Dingle Marsh.

Paul Mason and Justin Elsner worked together to study diel oxygen cycles, oxygen demand from the water (BOD) and sediments (SOD), and sediment nutrient release. Recording oxygen sondes deployed for 2-3 days recorded large diel swings of DO levels at two of three sites in Cutler Reservoir, with supersaturated oxygen in the afternoons and concentrations of less than 1.8 mg/L at dawn. One site in Cutler, however, had relatively limited changes in oxygen over the diel period. Oxygen levels in Dingle Marsh had only minor diel fluctuations and were always above 6 mg/L.. Average BOD levels were over four times higher in Cutler Reservoir than in Dingle Marsh (4.4 mg/L vs. 0.9 mg/L). However, Cutler and Dingle had similar sediment oxygen demands. Laboratory incubations of sediment cores indicated significantly higher phosphorus release rates from Cutler sediments (89 µg P m^{-2} d^{-1}), whereas the sediments from Dingle Marsh actually absorbed nutrients from the water column (-2 µg P m^{-2} d^{-1}).

Ben Abbott used field measurements of N and P and a 12-day laboratory bioassay to study the relative importance of nitrogen and phosphorus for limiting phytoplankton growth in Cutler Reservoir and Dingle Marsh. In central Cutler Reservoir average concentrations of TP were 0.82 mg L^{-1}, and TN levels averaged 1.27 mg L^{-1}. The resulting TN:TP ratio was 1.3:1. Mean nutrient concentrations in Mud Lake were much lower with 0.05 mg L^{-1} for TP, 0.53 mg L^{-1} for TN, and 10.3 for the TN:TP ratio. The bioassay indicated that phytoplankton growth in Cutler Reservoir near the wastewater treatment discharge was primarily limited by nitrogen and not by phosphorus. Dingle Marsh exhibited co-limitation with relatively low chlorophyll *a* levels in all treatments. In both wetlands, treatments receiving P additions showed an increase in the relative abundance of cyanobacteria.

Jared Randall utilized stable isotope analysis of carbon and nitrogen in Dingle and Cutler marshes, and well as the Logan Wastewater Treatment Plant's Polishing Wetlands (WWTP) to help understand: (1) whether these food webs are supported by phytoplankton and/or benthic algal production, and; (2) the relative importance of nitrogen pollutants versus natural nitrogen sources for the food web. The WWTP samples and those from Cutler Reservoir had similarly high average $\delta^{15}N$ enrichment values (12.1‰ and 11.4‰, respectively), whereas enrichments in Dingle Marsh were much lower (4.8‰). This suggests that a large portion of the nitrogen reaching Cutler Reservoir is from anthropogenic sources such as animal feedlots and wastewater treatment facilities. The analysis of carbon isotopes indicated that benthic invertebrates in Cutler were largely supported by periphyton and perhaps decomposing macrophytes. Zooplankton, as expected, were supported primarily by phytoplankton production. The carbon isotopic signature of juvenile largemouth bass was midway between the signatures of phytoplankton and periphyton, suggesting that the predatory fishes in the reservoir rely on a food base from both of these sources.

Overall, the results of the class study suggest that Cutler Reservoir is much more eutrophic than Dingle Marsh (Mud Lake), and that this eutrophication is due to human causes such as nutrient loading from dairies, feedlots and wastewater treatment plants. Both nitrogen and phosphorus are important in controlling algal and cyanobacterial growth, at least at our study site near the wastewater treatment plant discharge. Internal cycling of nutrients from the sediments of Cutler Reservoir will likely continue to promote algal growth for some time, even if external sources are eliminated. Analyses of European systems suggest that 10-15 years may be necessary for internal loading to diminish significantly. The stable isotope analyses indicate that both the plankton and the benthic food web are important in supporting sport fish production in the reservoir and future work will need to focus on both of these components to fully understand how eutrophication may impact the humans, fish and birds that utilize the wetland.

2009 Project Report

Limnological Analyses of Cutler Reservoir and Dingle Marsh with Respect to Eutrophication

Aquatic Ecology Practicum (WATS 4510) Class Report
Watershed Sciences Department
College of Natural Resources
Utah State University
Logan, UT 84322-5210

Students
J.D. Abbott, Deb Collins, Colin Cook,
Dan Lamarra, Ryan Leonard, Ben Marret,
Justin Stout and Gil Rowley

Edited by

Jeremy Mears
and
Wayne A. Wurtsbaugh

Limnological Analyses of Cutler Reservoir and Dingle Marsh with Respect to Eutrophication

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URL links to electronic version:
http://www.cnr.usu.edu/htm/facstaff/memberID=860 or
http://www.bearriverinfo.org/library/object.aspx?id=210

Cover Photo: Gil Rowley

Acknowledgements

We would like to thank Mike Allred of the Utah Division of Water Quality and Eve Davies from PacifiCorp for their support of the project. Phaedra Budy, Peter MacKinnon and Gary Thiede helped provide logistical support. Ian Washbourne and staff at the DWQ helped analyze nutrient samples. Toby Hooker provided useful advice on sample preparation and analyzed isotopic samples. Annette de Knijf from the US Fish and Wildlife Service facilitated our work in Dingle Marsh. Funding for the project was provided by PacifiCorp, the Utah Division of Water Quality and Bridgerland Audubon Society. We especially want to thank Department Head Chris Luecke for his continued support of the class that makes these student projects possible.

Executive Summary

Cutler Reservoir is located in Cache county, Utah and was created for the purposes of irrigation, water storage and flood control. High nutrient loading to Cutler has raised concerns about the health of this system and has resulted in it being listed on the state's 303(d) list of impaired waters. The TMDL plan being drafted for Cutler lists dissolved oxygen and phosphorous as the key issues of concern. The underlying problem created by nutrient loading is eutrophication. If Cutler is to remain as a valuable source of recreation, wildlife habitat, and water for the Cache Valley we must understand the underlying processes that control the system.

In September, 2009, Dr. Wayne Wurtsbaugh's Aquatic Ecology course began a series of student projects to better understand certain ecological and limnological characteristics of Cutler reservoir. Dr. Wurtsbaugh's classes from previous years have also analyzed limnological characteristics of Cutler Reservoir and Dingle Marsh. Dingle Marsh (Idaho) is a less impacted reference site situated higher in the watershed. The student projects were quite diverse this year and touched on a variety subjects.

Gil Rowley's study compared dissolved oxygen, total phosphorous and chlorophyll *a* levels at 17 sites throughout Cutler Reservoir, and additional samples were taken in Dingle Marsh. The mean value for chlorophyll *a* in Cutler was 32 μg/L indicating that the reservoir was eutrophic. However, concentrations ranged from 4 μg/L in the southern area, to 107 μg/L near the discharge of the Logan Wastewater Treatment Plant. Dissolved oxygen levels were measured at dawn to capture the lowest diel concentrations. Nevertheless, mean oxygen levels were high, with a mean of 8.9 mg/L, but there was significant spatial variability. The mean total phosphorous concentration was 0.22 mg/L, again indicating a eutrophic state. Mean respective concentrations of the limiting nutrient in Cutler and Dingle (nitrogen) were 1.08 and 0.45 mg TN/L. Gil demonstrated that the minimum oxygen concentrations in Cutler were negatively correlated with total phosphorous and chlorophyll *a* concentrations.

Justin Stout used recording oxygen sondes to asses the effects of two emergent bulrush beds on dissolved oxygen levels near the Logan & Little Bear River inflows to Cutler Reservoir. Both the minimum and maximum oxygen concentrations were generally lower at sites in or below the bulrush beds, than at up-flow sites, but the results were not statistically significant. Justin also found very high oxygen concentrations (diel range 9.6 to 20.7 mg/L) during the September study. Justin's project raises interesting questions regarding the interaction of these aquatic plants and oxygen levels. Peak saturation levels were >250% indicating that high oxygen levels may be toxic to fish in Cutler at this time of the year.

Dan Lamarra analyzed stable isotopes of nitrogen and carbon from cores and surficial sediments to understand patterns in nutrient deposition over time and space between Cutler Reservoir and Dingle Marsh. Cutler Reservoir and other sites within Cache Valley were significantly more enriched with the $\delta^{15}N$ stable isotope than were the sediments in Dingle Marsh. This suggests that sites with higher anthropogenic inputs are steadily enriched along and within the watershed as one moves from areas of low to high anthropogenic impacts.

Continuing with stable isotope analysis, Collin Cook's project focused on aquatic food webs in the Cutler and Dingle wetlands. Collin's project showed that Cutler was more enriched with the stable isotope of nitrogen across multiple trophic levels compared to Dingle Marsh. The elevated levels of $\delta^{15}N$ values again suggest higher level of anthropogenic nutrient inputs to Cutler than to Dingle Marsh.

Ryan Leonard and Ben Marett used aquatic invertebrate biotic indices and density estimates to compare Dingle and Cutler. The benthic invertebrate samples collected in their project are some of the largest taken to date and will allow for future studies to compare changes over time. Dingle Marsh higher had a higher number of pollution intolerant taxa than in Cutler. Hilsenhoff Biotic Indices indicted that Cutler had lower water quality than Cutler, but the differences were not large. Overall benthic invertebrate densities were very low in both systems, but densities were twice as high in Dingle as in Cutler. Although these differences were not statistically significant, taken together, they suggest that Cutler Reservoir is impaired relative to the reference site.

The final report was created by J.D. Abbott and Deb Collins to look at paleolimnogical characteristics of Cutler Reservoir. A 19.5-cm long core was collected from the northern part of the reservoir and 25 sections were extracted to analyze sediment phosphorous, nitrogen and phaeophytin pigments (the product of chlorophyll degradation) over time. Portions of each section were sent out for lead-210 analysis and dated. The lead 210 data suggest that the sediments at the collection site had been disturbed, making it impossible to give an accurate chronology for the different depth strata. Nevertheless, the best estimate for the sediment core dating suggests that the core spanned from 2009-1933. Phosphorous levels increased from 0.6 mg P/g in ~1933 to approximately 0.75 mg P/g in 2009. Nitrogen and carbon concentrations also increased 25-30% over the span of the core, but phaeophytin pigment levels displayed no pattern with time.

Overall, the chemical and biological results indicate that Cutler Reservoir is affected by nutrient loading and that it is moderately eutrophic. However, during the September study, oxygen levels were relatively high; suggesting that impairment at this time of the year was not severe.

Sampling in Cutler Reservoir

WATS 3110. 28 September 2010. Cutler Reservoir Field Trip

Background

Cutler Reservoir is a privately-owned reservoir located in Cache Valley (Box Elder and Cache counties; 41°50' N 112°02' W), Utah. Cutler Dam was built by Utah Power and Light (now owned by Pacific Corp) in 1927. The dam is a concrete gravity arch 545 feet wide and 112 feet high. Cutler Dam impounds the waters of the Bear, Logan, and Little Bear rivers as well as Spring Creek and many, other small drainages. The Bear River enters the reservoir from the southeast (Figure 1).

Cutler Reservoir is approximately 19 km long with a maximum capacity of 23,802 acre-feet. At elevation of 1343.6 m ("normal") above sea level, the surface area of Cutler Reservoir is 9,601,200 m^2 or about 9.6 km^2.

Objectives

- Learn about the diverse fish community of a typical warm-water reservoir (lake) that may be impacted by proximity to a urban center
- Obtain knowledge about fish sampling (gill netting, trap netting, seining, and minnow trapping), fish handling, and processing of spiny-rayed fishes
- Learn to identify fish using outstanding characteristics (e.g., opercular lobes, spines, rays, fins, length of mouth). *Take some notes. Make some drawings.*

Table 1. Fishes found in Cutler Reservoir, and classification in terms of tolerance of degradation of water quality (from Jester et al. 1992). List is in sequential order from most intolerant (top) to most tolerant (bottom). Notation for water quality tolerance designations: T = tolerant (score = 4.0), MT = moderately tolerant (score = 2.6 – 3.3), MI = moderately intolerant (score = 1.8 – 2.5), I = intolerant (score = 1.0 – 1.7).

Species	Water quality tolerance	Numerical tolerance score (± SD)	Occurrence in Cutler Reservoir in 2006
Brown trout	I	*Not quantified*	Few at Site 1
Smallmouth bass	I	1.5 (0.55)	Few at 3 of 5 sites
Utah sucker	MI[a]	1.8 (0.45)[a]	Few at all sites
Walleye	MT	2.8 (0.96)	Occur at all sites
Bluegill	MT	3.2 (0.41)	Many at all sites
Black crappie	MT	3.2 (0.45)	Many at all sites
Channel catfish	MT	3.2 (0.55)	Many at all sites
Largemouth bass	MT	3.2 (0.98)	Occur at all sites
Fathead minnow	T	3.7 (0.52)	Many at all sites
Common carp	T	4.0 (0.0)	Many at all sites
Green sunfish	T	4.0 (0.0)	Many at all sites
Black bullhead	T	4.0 (0.0)	Many at all sites

a. Value for white sucker, *Catostomus commersoni*

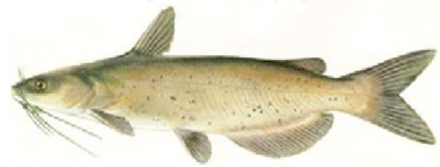
Fishes we may encounter today

black crappie
(*Pomoxis nigromaculatus*)

black bullhead
(*Ameiurus melas*)

bluegill sunfish
(*Lepomis macrochirus*)

brown trout (*Salmo trutta*)



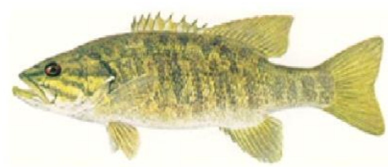
channel catfish (*Ictalurus punctatus*)

fathead minnow
(*Pimephales promelas)*

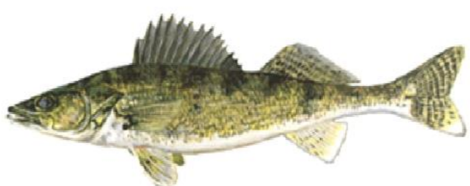
common carp
(*Cyprinus carpio*)

green sunfish
(*Lepomis cyanellus*)

largemouth bass (*Micropterus salmoides*)



smallmouth bass (*Micropterus dolomieu*)



walleye (*Sander vitreus*)

Utah sucker (*Catostomus ardens*)

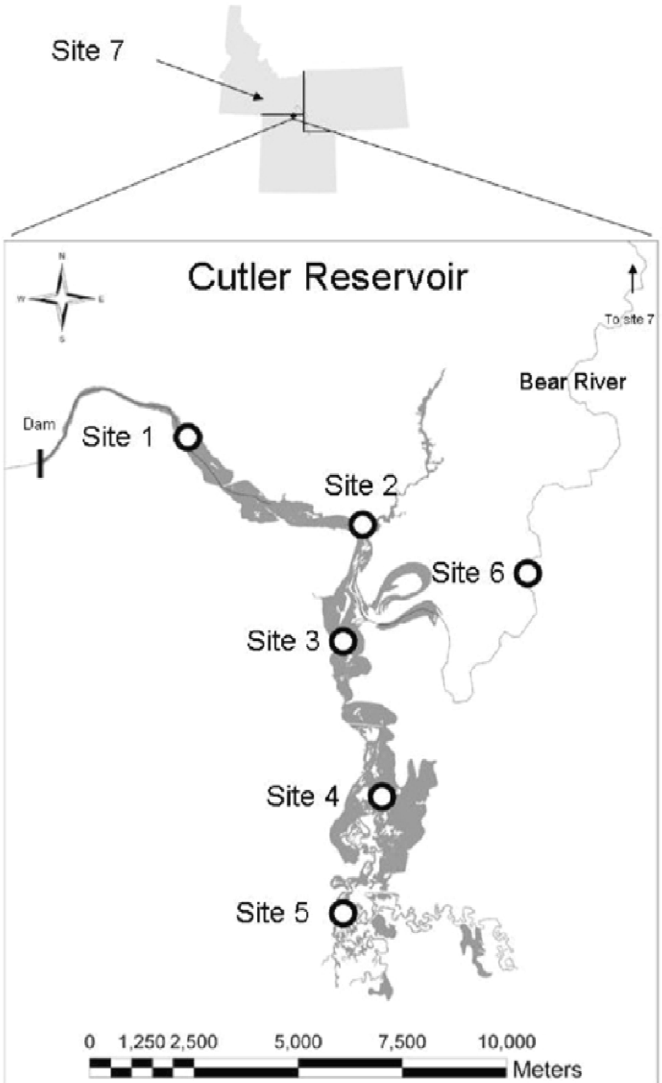


Figure 1. Map of Cutler Reservoir with five (sites 1 – 5) reservoir index locations and two (sites 6 and 7) Bear River index locations indicated. Benson "marina" and boat launch is near Site 3 (on map).

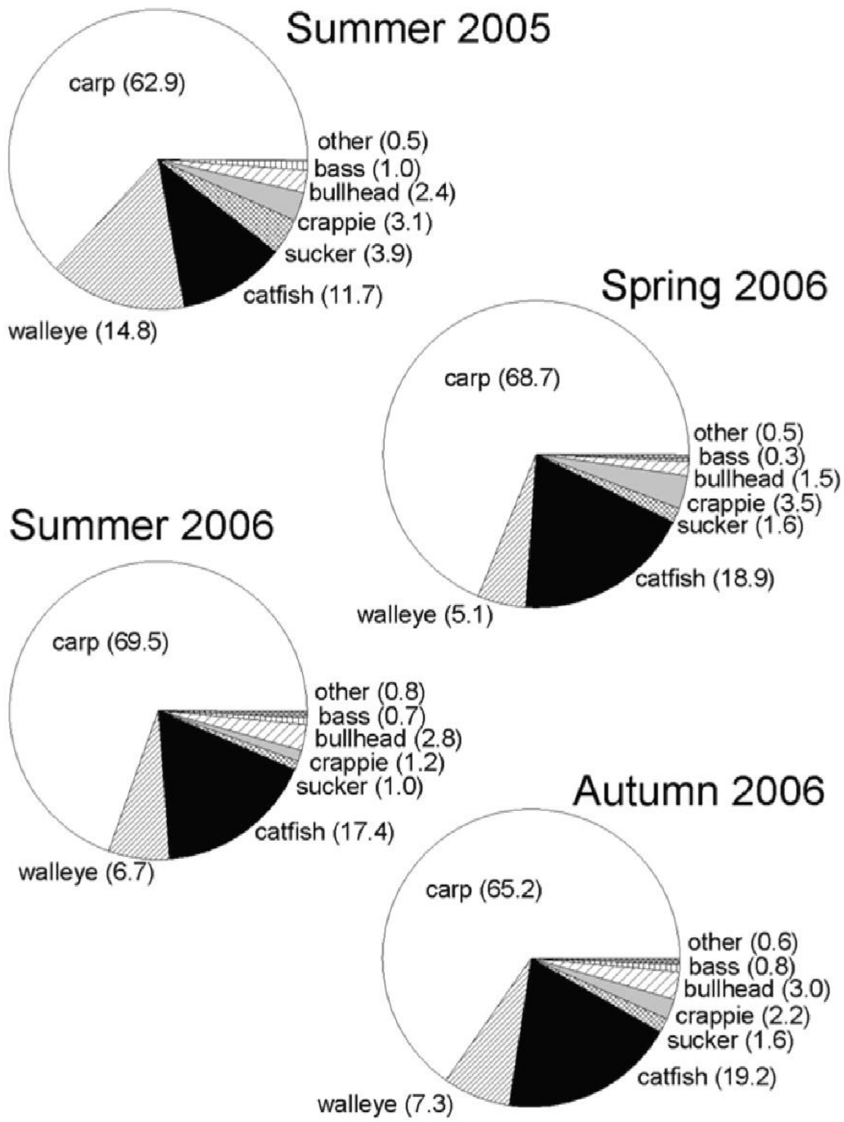


Figure 2. Biomass (as percentage of total kg) of fish by species captured by all sampling methods at all sites on Cutler Reservoir and two sites on the Bear River, summer 2005 and seasonally in 2006. Bass include smallmouth and largemouth. Actual percentages are given in parentheses. Other includes bluegill sunfish, green sunfish, and fathead minnow.

APPENDIX F-2

BUDY UNPUBLISHED DATA
USU FISHERIES CLASS NOTES AND
CUTLER FISH SAMPLING DATA

Date of Activity	Location	Common Name	Scientific Name	Number of Animals	Age	Sex	Activity	Disposition of Specimen
7 – 8 Sept 2009	Near Benson marina	Channel catfish	*Ictalurus punctatus*	1	Various	M/F	Gill netting, seining, or trap netting	Weighed, Measured, Released
7 – 8 Sept 2009	Near Benson marina	Common carp	*Cyprinus carpio*	88	Various	M/F	Gill netting, seining, or trap netting	Weighed, Measured, Released
7 – 8 Sept 2009	Near Benson marina	Black bullhead	*Ameiurus melas*	72	Various	M/F	Gill netting, seining, or trap netting	Weighed, Measured, Released
7 – 8 Sept 2009	Near Benson marina	Black crappie	*Pomoxis nigromaculatus*	18	Various	M/F	Gill netting or trap netting	Weighed, Measured, Released
7 – 8 Sept 2009	Near Benson marina	Largemouth bass	*Micropterus salmoides*	52	Various	M/F	Seining or trap netting	Weighed, Measured, Released
7 – 8 Sept 2009	Near Benson marina	Walleye	*Sander vitreum*	3	Various	M/F	Gill netting	Weighed, Measured, Released
7 – 8 Sept 2009	Near Benson marina	Bluegill sunfish	*Lepomis macrochirus*	9			Seining or trap netting	Weighed, Measured, Released
7 – 8 Sept 2009	Near Benson marina	Green sunfish	*Lepomis cyanellus*	2	Various	M/F	Gill netting, seining, or trap netting	Weighed, Measured, Released
7 – 8 Sept 2009	Near Benson marina	Utah sucker	*Catastomus ardens*	1	--	--	Gill netting	Weighed, Measured, Released
7 – 8 Sept 2009	Near Benson marina	Fathead minnow	*Pimephales promelas*	1	Various	M/F	Seining	Weighed, Measured, Released
7 – 8 Sept 2009	Near Benson marina	Smallmouth bass	*Micropterus dolomieu*	6	Various	M/F	Gill netting, seining, or trap netting	Weighed, Measured, Released

Cutler Reservoir field trip. WATS 3110. Phaedra Budy

Benson Marina area.

Collections made on 28 September 2010

Set period: Set on 27 Sept from 6:25 - 7:16 pm. Pulled from 2 - 4 pm on 28 Sept 2010

Gear info	Species info	Species	Count	Notes
Gill net 2	YOY carp	Carp	27	
Gill net 2	YOY LMB	Bass	2	
Gill net 2	adult LMB	Bass	3	
Gill net 2	Adult carp	Carp	8	
Gill net 2	bullhead	Bullhead	16	
Gill net 2	Walleye	Walleye	1	
Gill net 2	Utah sucker	Utah sucker	2	
Gill net 2	channel cat	Catfish	3	
Gill net 2	yellow perch	Perch	1	
Gill net 1	walleye	Walleye	8	
Gill net 1	crappie	Crappie	5	
Gill net 1	adult carp	Carp	11	
Gill net 1	YOY carp	Carp	11	
Gill net 1	bluegill	Bluegill	1	
Gill net 1	bullhead	Bullhead	43	
Gill net 1	channel cat	Catfish	9	
Gill net 1	bass, SMB?	Bass	11	
Gill net 1	carp	Carp	5	
trap net 1	crappie	Crappie	1	
trap net 1	carp	Carp	1	
Trap net 2	crappie	Crappie	6	
Trap net 2	carp	Carp	6	

Gear info	Species info	Species	Count	Notes
Trap net 2	LMB	Bass	1	
Seine 1	YOY carp	Carp	260	
Seine 1	fathead minnow	Fathead minnow	350	
Minnow trap 1	green sunfish	Green sunfish	14	set 1 = 6 traps
Minnow trap 1	YOY carp	Carp	2	
Minnow trap 1	crappie	Crappie	1	
Minnow trap 2	green sunfish	Green sunfish	10	set 2 = 6 traps
Minnow trap 2	YOY carp	Carp	41	
Minnow trap 2	fathead minnow	Fathead minnow	5	

Fish name	Totals by fish
Bass, *Micropterus*	17
Bluegill, *Lepomis*	1
Bullhead	59
Carp	372
Catfish, *Ictalurus*	12
Crappie	13
Fathead minnow	355
Green sunfish	24
Perch, *Perca*	1
Utah sucker	2
Walleye	9
Grand Total	***865***

Sampling by WATS 3110 class, Phaedra Budy, Professor
September 2011

	LMB	SMB	BKC	GRS	BLG	CLC	WYE	BKB	CNC	FHM	UHS
GILL NET 1; NORTH OF BRIDGE (GROUP 1)	-	-	1	-	-	7	3	5	7	-	-
GILL NET 2; SOUTH OF BRIDGE (GROUP 2)	-	-	2	-	-	8	-	4	13	-	3
TRAP NET 1	-	-	2	1	-	-	-	-	-	-	-
TRAP NET 2	-	-	1	-	-	-	-	-	-	-	-
SEINE 1	1	1	3	-	-	-	-	-	-	170	-
SEINE 2	-	-	-	-	-	-	-	-	-	82	-
MINNOW TRAP 1	-	-	-	-	-	-	-	-	-	-	-
MINNOW TRAP 2	-	-	2	-	-	-	-	-	-	-	-

KEY:

LMB	Largemouth bass
SMB	Smallmouth bass
BKC	Black crappie
GRS	Green sunfish
BLG	Bluegill sunfish
CLC	Channel catfish
WYE	Walleye
BKB	Black bullhead
CNC	Common carp
FHM	Fathead minnow
UHS	Utah sucker

Date of Activity	Location	Common Name	Scientific Name	Number of Animals	Age	Sex	Activity	Disposition of Specimen
Sept 2012	Cutler Reservoir	Bluegill	*Lepomis macrochirus*	165	Various	M/F	Seine/minnow trapping	Weighed and measured
Sept 2012	Cutler Reservoir	Largemouth Bass	*Micropterus salmoides*	17	Various	M/F	Gill netting/seine	Same as above
Sept 2012	Cutler Reservoir	Fathead Minnow	*Pimephales promelas*	19	Various	M/F	seine	Same as above
Sept 2012	Cutler Reservoir	Smallmouth Bass	*Micropterus dolomieu*	6	Various	M/F	Gill netting/seine	Same as above
Sept 2012	Cutler Reservoir	Black Bullhead Catfish	*Ameiurus melas*	16	Various	M/F	Gill netting	Same as above
Sept 2012	Cutler Reservoir	Green Sunfish	*Lepomis cyanellus*	19	Juvenile	M/F	Seine	Same as above
Sept 2012	Cutler Reservoir	Black Crappie	*Pomoxis nigromaculatus*	2	Juvenile	?	Seine	Same as above
Sept 2012	Cutler Reservoir	Carp	*Cyprinus carpio*	32	Various	M/F	Gill netting	Same as above
Sept 2012	Cutler Reservoir	Walleye	*Sander vitreus*	20	Adult	M/F	Gill netting	Same as above
Sept 2012	Cutler Reservoir	Channel Catfish	*Ictalurus punctatus*	6	Adult	M/F	Gill/Trap netting	Same as above
Sept 2012	Cutler Reservoir	Utah Sucker	*Catostomus ardens*	1	Adult	M/F	Gill netting	Same as above

Specific location	Gear type	Net number	Species	TL (mm)	Wt (g)
Benson marina	Seine	2	Black crappie	75	7.7
Benson marina	Seine	2	Black crappie	86	8.3
Benson marina	seine	1	Bluegill	47	1.9
Benson marina	seine	1	Bluegill	64	4.2
Benson marina	seine	1	Bluegill	44	1.4
Benson marina	seine	1	Bluegill	63	4.5
Benson marina	seine	1	Bluegill	53	2.1
Benson marina	seine	1	Bluegill	47	1.7
Benson marina	seine	1	Bluegill	44	1.4
Benson marina	seine	1	Bluegill	68	5.4
Benson marina	seine	1	Bluegill	59	3.2
Benson marina	seine	1	Bluegill	59	3.8
Benson marina	seine	1	Bluegill	49	1.7
Benson marina	seine	1	Bluegill	41	1.2
Benson marina	seine	1	Bluegill	44	1.5
Benson marina	seine	1	Bluegill	58	1.5
Benson marina	seine	1	Bluegill	75	6.7
Benson marina	seine	1	Bluegill	57	2.7
Benson marina	seine	1	Bluegill	46	2.2
Benson marina	seine	1	Bluegill	43	1.2
Benson marina	seine	1	Bluegill	50	1.8
Benson marina	seine	1	Bluegill	53	2.4
Benson marina	seine	1	Bluegill	45	1.2
Benson marina	seine	1	Bluegill	66	3.7
Benson marina	seine	1	Bluegill	49	1.3
Benson marina	seine	1	Bluegill	59	2.4
Benson marina	seine	1	Bluegill	45	0.7
Benson marina	seine	1	Bluegill	49	1.6
Benson marina	seine	1	Bluegill	49	1.7

Specific location	Gear type	Net number	Species	TL (mm)	Wt (g)
Benson marina	seine	1	Bluegill	56	2.3
Benson marina	seine	1	Bluegill	48	1.3
Benson marina	seine	1	Bluegill	46	1.7
Benson marina	seine	1	Bluegill	58	3.1
Benson marina	seine	1	Bluegill	44	0.9
Benson marina	seine	1	Bluegill	49	1.4
Benson marina	seine	1	Bluegill	43	1.3
Benson marina	seine	1	Bluegill	52	2.6
Benson marina	seine	1	Bluegill	50	1.8
Benson marina	seine	1	Bluegill	41	1.5
Benson marina	seine	1	Bluegill	54	3
Benson marina	seine	1	Bluegill	48	1.7
Benson marina	seine	1	Bluegill	45	1.4
Benson marina	seine	1	Bluegill	46	1.4
Benson marina	seine	1	Bluegill	44	1.8
Benson marina	seine	1	Bluegill	51	2.4
Benson marina	seine	1	Bluegill	50	1.7
Benson marina	seine	1	Bluegill	68	3.7
Benson marina	seine	1	Bluegill	65	5.9
Benson marina	seine	1	Bluegill	42	0.7
Benson marina	seine	1	Bluegill	58	3
Benson marina	seine	1	Bluegill	59	3.3
Benson marina	seine	1	Bluegill	46	1.5
Benson marina	seine	1	Bluegill	44	1.3
Benson marina	seine	1	Bluegill	52	
Benson marina	seine	1	Bluegill	54	2.5
Benson marina	seine	1	Bluegill	48	2.1
Benson marina	seine	1	Bluegill	53	2.4
Benson marina	seine	1	Bluegill	47	1.6

Specific location	Gear type	Net number	Species	TL (mm)	Wt (g)
Benson marina	seine	1	Bluegill	64	3.9
Benson marina	seine	1	Bluegill	52	2.1
Benson marina	seine	1	Bluegill	41	0.7
Benson marina	seine	1	Bluegill	55	2.6
Benson marina	Gillnet	1	Bluegill	45	1
Benson marina	Gillnet	1	Bluegill	44	1
Benson marina	Gillnet	1	Bluegill	46	1
Benson marina	Seine	2	Bluegill	62	3.2
Benson marina	Seine	2	Bluegill	51	1.5
Benson marina	Seine	2	Bluegill	50	1.8
Benson marina	Seine	2	Bluegill	55	1.3
Benson marina	Seine	2	Bluegill	55	2.3
Benson marina	Seine	2	Bluegill	45	1.2
Benson marina	Seine	2	Bluegill	46	1.4
Benson marina	Seine	2	Bluegill	46	1.3
Benson marina	Seine	2	Bluegill	51	1.8
Benson marina	Seine	2	Bluegill	60	6
Benson marina	Seine	2	Bluegill	55	9
Benson marina	Minnow trap	2	Bluegill	45	1.6
Benson marina	Minnow trap	2	Bluegill	41	1
Benson marina	Minnow trap	2	Bluegill	53	2.4
Benson marina	Minnow trap	2	Bluegill	39	1.5
Benson marina	Minnow trap	2	Bluegill	40	0.9
Benson marina	Minnow trap	2	Bluegill	43	0.7
Benson marina	Minnow trap	2	Bluegill	42	1.1
Benson marina	seine	1	Bullhead	102	14.5
Benson marina	Gillnet	1	Bullhead	155	51
Benson marina	Gillnet	1	Bullhead	130	32
Benson marina	Gillnet	1	Bullhead	194	104

Specific location	Gear type	Net number	Species	TL (mm)	Wt (g)
Benson marina	Gillnet	1	Bullhead	214	132
Benson marina	Gillnet	1	Bullhead	86	76
Benson marina	Gillnet	1	Bullhead	230	145
Benson marina	Gillnet	1	Bullhead	180	85
Benson marina	Gillnet	1	Bullhead	140	30
Benson marina	Gillnet	1	Bullhead	212	149
Benson marina	Gillnet	2	Bullhead	170	154
Benson marina	Gillnet	2	Bullhead	180	177
Benson marina	Gillnet	2	Bullhead	176	130
Benson marina	Trapnet	2	Bullhead	214	157
Benson marina	Gillnet	2	Bullhead	230	158
Benson marina	Gillnet	2	Bullhead	226	153
Benson marina	Gillnet	1	Carp	150	51
Benson marina	Gillnet	1	Carp	125	26
Benson marina	Gillnet	1	Carp	366	230
Benson marina	Gillnet	1	Carp	116	63
Benson marina	Gillnet	1	Carp	480	1080
Benson marina	Gillnet	1	Carp	158	52
Benson marina	Gillnet	1	Carp	118	23
Benson marina	Gillnet	1	Carp	460	730
Benson marina	Gillnet	1	Carp	340	480
Benson marina	Gillnet	1	Carp	450	960
Benson marina	Gillnet	1	Carp	120	25
Benson marina	Gillnet	1	Carp	111	19
Benson marina	Gillnet	2	Carp	56	164
Benson marina	Gillnet	2	Carp	445	975
Benson marina	Gillnet	2	Carp	370	584
Benson marina	Gillnet	2	Carp	435	980
Benson marina	Gillnet	2	Carp	422	944

Specific location	Gear type	Net number	Species	TL (mm)	Wt (g)
Benson marina	Gillnet	2	Carp	399	785
Benson marina	Gillnet	2	Carp	137	49
Benson marina	Gillnet	2	Carp	425	880
Benson marina	Trapnet	2	Carp	412	940
Benson marina	Trapnet	2	Carp	584	2450
Benson marina	Gillnet	2	Carp	456	1200
Benson marina	Gillnet	2	Carp	444	1080
Benson marina	Gillnet	2	Carp	464	2100
Benson marina	Gillnet	2	Carp	427	880
Benson marina	Gillnet	2	Carp	427	1000
Benson marina	Gillnet	2	Carp	341	480
Benson marina	Gillnet	2	Carp	209	132
Benson marina	Gillnet	2	Carp	274	240
Benson marina	Gillnet	2	Carp	143	45.9
Benson marina	Trapnet	1	Channel Cat	651	2500
Benson marina	Gillnet	1	Channel Cat	407	500
Benson marina	Gillnet	1	Channel Cat	220	132
Benson marina	Gillnet	2	Channel Cat	386	380
Benson marina	Gillnet	2	Channel Cat	451	740
Benson marina	Gillnet	2	Channel Cat	601	1900
Benson marina	Seine	2	Fathead minnow	49	0.8
Benson marina	Seine	2	Fathead minnow	31	0.2
Benson marina	Seine	2	Fathead minnow	39	0.4
Benson marina	Seine	2	Fathead minnow	38	0.4
Benson marina	Seine	2	Fathead minnow	41	0.3
Benson marina	Seine	2	Fathead minnow	31	0.2
Benson marina	Seine	2	Fathead minnow	31	0.3
Benson marina	seine	1	FHM	65	2.2
Benson marina	seine	1	FHM	43	0.6

Specific location	Gear type	Net number	Species	TL (mm)	Wt (g)
Benson marina	seine	1	FHM	29	0.2
Benson marina	seine	1	FHM	53	0.6
Benson marina	seine	1	FHM	64	2.1
Benson marina	seine	1	FHM	55	1.2
Benson marina	seine	1	FHM	46	0.8
Benson marina	seine	1	FHM	48	0.8
Benson marina	seine	1	FHM	62	2
Benson marina	seine	1	FHM	45	0.5
Benson marina	seine	1	FHM	54	1.2
Benson marina	seine	1	FHM	19	0.1
Benson marina	seine	1	FHM	51	1.1
Benson marina	Seine	2	Green sunfish	62	3.8
Benson marina	Seine	2	Green sunfish	60	3.1
Benson marina	Seine	2	Green sunfish	44	1.1
Benson marina	Seine	2	Green sunfish	50	1.8
Benson marina	Seine	2	Green sunfish	56	2.8
Benson marina	Seine	2	Green sunfish	56	2.3
Benson marina	Seine	2	Green sunfish	46	0.8
Benson marina	Seine	2	Green sunfish	43	1.5
Benson marina	Seine	2	Green sunfish	44	1.3
Benson marina	Seine	2	Green sunfish	65	4.6
Benson marina	Seine	2	Green sunfish	72	6.8
Benson marina	Seine	2	Green sunfish	54	2.5
Benson marina	Seine	2	Green sunfish	56	3.1
Benson marina	Seine	2	Green sunfish	69	6
Benson marina	Minnow trap	2	Green sunfish	62	3.2
Benson marina	Minnow trap	2	Green sunfish	45	1.3
Benson marina	Minnow trap	2	Green sunfish	69	5.5
Benson marina	Minnow trap	2	Green sunfish	57	3.1

Specific location	Gear type	Net number	Species	TL (mm)	Wt (g)
Benson marina	Minnow trap	2	Green sunfish	37	0.5
Benson marina	Seine	2	Large mouth bass	105	13.6
Benson marina	Seine	2	Large mouth bass	65	2.8
Benson marina	Seine	2	Large mouth bass	81	6.1
Benson marina	Seine	2	Large mouth bass	111	
Benson marina	Seine	2	Large mouth bass	131	
Benson marina	Seine	2	Large mouth bass	86	6.5
Benson marina	Seine	2	Large mouth bass	87	6.8
Benson marina	Seine	2	Large mouth bass	152	49.6
Benson marina	Seine	2	Large mouth bass	139	39.8
Benson marina	Seine	2	Large mouth bass	146	46
Benson marina	Gillnet	2	Large mouth bass	300	530
Benson marina	Gillnet	2	Large mouth bass	381	1168
Benson marina	seine	1	LMB	100	9.8
Benson marina	seine	1	LMB	112	15.5
Benson marina	seine	1	LMB	115	7.4
Benson marina	seine	1	LMB	145	41.4
Benson marina	Gillnet	1	LMB	257	245
Benson marina	Gillnet	2	LMB	299	500
Benson marina	Gillnet	1	Smallmouth bass	595	2000
Benson marina	Seine	2	Smallmouth bass	84	7.8
Benson marina	Seine	2	Smallmouth bass	95	9.6
Benson marina	Seine	2	Smallmouth bass	90	9.1
Benson marina	seine	1	SMB	85	8.2
Benson marina	Gillnet	2	Utah Sucker	491	1400
Benson marina	Gillnet	1	Walleye	480	1030
Benson marina	Gillnet	1	Walleye	480	990
Benson marina	Gillnet	1	Walleye	361	430
Benson marina	Gillnet	1	Walleye	455	800

Specific location	Gear type	Net number	Species	TL (mm)	Wt (g)
Benson marina	Gillnet	1	Walleye	656	3100
Benson marina	Gillnet	1	Walleye	476	900
Benson marina	Gillnet	1	Walleye	650	2200
Benson marina	Gillnet	1	Walleye	515	1700
Benson marina	Gillnet	1	Walleye	462	920
Benson marina	Gillnet	1	Walleye	450	590
Benson marina	Gillnet	1	Walleye	537	1500
Benson marina	Gillnet	1	Walleye	381	540
Benson marina	Gillnet	1	Walleye	581	1900
Benson marina	Gillnet	2	Walleye	445	820
Benson marina	Gillnet	2	Walleye	562	1970
Benson marina	Gillnet	2	Walleye	468	920
Benson marina	Gillnet	2	Walleye	601	2000
Benson marina	Gillnet	2	Walleye	604	2100
Benson marina	Gillnet	2	Walleye	442	810
Benson marina	Gillnet	2	Walleye	379	520

Each year, we set 2 gill nets, 2 trap nets, pulled seines (2 - 4 hauls), and set paired minnow traps.
Nets were set around 6 pm the evening before the class. Nets were pulled at class time, around 1 pm.
All nets were set within 500 meters of the Benson Marina boat launch.
Trap nets were set perpendicular to shore with one lead line.
Gill nets were set perpendicular to shore, upstream and downstream of the road bridge near Benson Marina.
Seine hauls were conducted at or near the boat ramp, gravel and cement areas.
Minnow traps were set northeast of the boat ramp.

APPENDIX G

WATER QUALITY REPORT

Water Quality Analysis and Summary for Cutler Reservoir, Utah

Prepared for

PacifiCorp

Prepared by

SWCA Environmental Consultants

August 2012

WATER QUALITY ANALYSIS AND SUMMARY FOR CUTLER RESERVOIR, UTAH

Prepared for

PacifiCorp

Prepared by

SWCA Environmental Consultants
257 East 200 South, Suite 200
Salt Lake City, Utah 84111

August 2012

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TABLES

FIGURES

EXECUTIVE SUMMARY

The water quality monitoring dataset collected by PacifiCorp around Cutler Reservoir covers a wide range of tributaries and reservoir locations and a variety of physical and chemical water quality constituents. Sample locations included Little Bear River, Spring Creek, Logan River, Bear River, Cutler Reservoir at Benson Marina, Cutler Reservoir east of Highway 23, Cutler Reservoir south of Swift Slough, and Bear River below Cutler Dam. Chemical parameters include nutrient concentrations of phosphorus (total and orthophosphate), nitrogen as NO_3, NO_2, and NH_3, and physical parameters include temperature, total suspended solids, and dissolved oxygen (DO) values. The samples were collected quarterly during three monitoring periods (1996–1998, 2000–2003, and 2006–2008). These three monitoring periods are characterized by varied hydrologic conditions, based on water discharged from Cutler Reservoir to the Bear River during these time periods. The monitoring period between 1996 and 1998 was characterized by wet conditions and high flows, while 2000–2003 was characterized by dry conditions with low flows. The most recent hydrologic period, from 2006–2008, is characterized by moderate flows, with 2008 being the driest of these three moderate flow years. Future samples will be collected quarterly at 5-year intervals throughout the remainder of the license (2024), beginning in 2013.

Differences in water quality parameters between the three monitoring periods are most likely related to the marked difference in hydrologic conditions. Data collected between 2000 and 2003 generally indicate increased temperature, reduced coliform bacteria, reduced turbidity, and increased concentrations of phosphorus throughout the Cutler Reservoir system compared to the earlier and later monitoring periods. Only small differences in pH, inorganic nitrogen, and DO were noted between the three monitoring periods.

Water quality varied by season and hydroperiod for most parameters analyzed across monitoring periods; however this variation appears to be site-specific, with different patterns emerging in the Bear River and Cutler Reservoir system compared to the southern tributaries. Turbidity is generally highest during the spring season while nutrient concentrations at some sites, including Cutler Reservoir, are generally highest in the summer season.

Data collected over the various monitoring periods between 1996 and 2008 indicate that water quality in the southern tributaries, specifically Spring Creek and the Little Bear River, and Swift Slough have dramatic impacts on water quality throughout Cutler Reservoir. Spring Creek continues to have significantly higher tributary nutrient concentrations as compared to the other sampling locations within the watershed. Water quality in the southern (south of Benson Marina) and northern (north of Benson Marina) sections of the Reservoir remains markedly different with the south being characterized by higher nutrient concentrations, higher turbidity, and lower DO. High nutrient loads to the southern reservoir are partly from point source discharges in Spring Creek (JBS Swift and Company) and Swift Slough (Logan City and Service Area Wastewater Treatment discharge). Due to slow-moving water and the shallow nature of the southern Reservoir (1.8 feet mean depth), reservoir sediments are likely to exert a greater influence on water quality there than in the faster-flowing and deeper northern Reservoir (3.6 feet mean depth).

1. INTRODUCTION

Cutler Reservoir is located 6 miles west of Logan, Utah, at an elevation of 4,407 feet. Cutler Dam impounds water from the Bear River, as well as from the Logan River, Little Bear River, Spring Creek, and several small tributaries and sloughs. The original Wheelon Dam was constructed in the second decade of the twentieth century; the current Cutler dam was constructed in 1927 by Utah Power and Light, the predecessor company to PacifiCorp Energy. Doing business in Utah as Rocky Mountain Power, PacifiCorp operates the facility to provide water for agricultural use, flood control, and power generation. The Federal Energy Regulatory Commission (FERC) license for Cutler Dam as a hydropower facility was renewed in 1994 and amended with a supplement in 2002. The amended license included the establishment of an operational elevation range (conservation pool) at which the reservoir would be maintained to support fish and wildlife in the reservoir, and development of the Cutler Resource Management Plan (hereafter referred to as the Cutler RMP) (PacifiCorp 2002). The Cutler RMP outlines specific requirements for wildlife habitat improvements, agricultural lease modifications, buffer establishment, bank stabilization, recreation site improvements, and other natural resources projects and monitoring. Cutler Reservoir has a maximum storage capacity of 15,386 acre-feet of water with a large surface area and shallow depth (averaging 3 feet deep), resulting in approximately 10,000 acres of open water and associated wetlands and uplands. The reservoir is operated in run-of-river mode such that water surface elevation is maintained between 4,406.25 feet and 4,407.75 feet from March 1 through December 1 and from 4,405.5 to 4,407.75 from December 2 through February 28. These ranges are required by PacifiCorp's FERC license filed in 1999 and supplemented in 2002.

The Cutler Reservoir watershed encompasses 2,201 square miles and lies within the larger Bear River basin of 6,900 square miles. The Bear River basin drains portions of northeastern Utah, southwestern Wyoming, and southeastern Idaho. The Cutler Reservoir watershed consists of a stream network that extends 2,022 linear miles, 16% of which consist of ditches or canals. Steep terrain (with slopes as high as 85 degrees) characterizes the mountains surrounding the relatively flat Cache Valley, where soils are made up of alluvium and ancient lacustrine sediments. The dominant land uses in the Cutler Reservoir watershed are forest and shrubland in the mountains, and agricultural land in Cache Valley. The most common crops include irrigated pasture, hay, alfalfa, and corn that are used locally to feed cattle and dairy cows. Developed land uses also occupy a portion of Cache Valley, primarily along the U.S. Highway 89 corridor.

Under Section 303(d) of the Clean Water Act, Cutler Reservoir has been identified as water quality limited due to low dissolved oxygen (DO) and excess phosphorus loading to the rivers and reservoir from the surrounding watershed. The designated beneficial uses determined by the State of Utah for Cutler Reservoir are secondary contact recreation (2B); warm-water game fish and their associated food chain (3B); waterfowl and shorebirds and their associated food chains (3D); and agricultural water supply (4). The warm-water game fish designated use (3B) was identified as impaired on Utah's 2008 Integrated 303(d) list. Secondary contact recreation (2B) and agricultural water supply (4) beneficial uses were deemed to be fully supported in Cutler Reservoir in 2008. However, the Middle Bear River and Cutler Reservoir total maximum daily loads (TMDLs) identified that the recreational (2B) and the waterfowl and shorebirds (3D) beneficial uses in Cutler Reservoir may also be impaired based on narrative water criteria.

PacifiCorp is actively working to improve wildlife habitat, water quality, and recreational uses on and around Cutler Reservoir through wetland mitigation, erosion control, grazing management, agricultural land management, and shoreline reclamation. As part of these efforts, and in compliance with the current FERC license, PacifiCorp monitors water quality at the mouth of tributaries to Cutler Reservoir and in the reservoir every 5 years. Water quality monitoring was conducted quarterly from 1996 through 1998, 2000 through 2003, and again in 2008; future monitoring will take place quarterly at 5-year intervals throughout the remainder of the license period (2013, 2018, and 2023). The data cover a wide range of watershed locations and a variety of physical and chemical water quality constituents.

In this report, water quality data collected during the third monitoring period (2008) are summarized and compared spatially, seasonally, and by hydroperiod to the two previous monitoring periods (1996–1998 and 2000–2003). Additional information from the two previous monitoring periods was provided in the 2008 *Water Quality Analysis and Summary for Cutler Reservoir, Utah*(PacifiCorp 2008) that covered monitoring period 2003–2007, inclusive.This report, covering data collected during the 2008 sampling effort, will be included in the next 5-year report to the FERC, which will cover the monitoring period 2008–2012, inclusive, and which is due in 2013.

2. WATER QUALITY DATA COLLECTION

SWCA Environmental Consultants (SWCA) collected water quality samples for PacifiCorp beginning in April 2008 and ending in January 2009. The following subsections describe the sampling methods used to collect samples, the analytical methods, and the temporal and spatial coverage of the samples collected.

2.1. Sampling Methods

Water quality samples were collected from just below the water surface at each sampling site.Where possible, most samples were collected from bridges using a rinsed bucket. YSI sondes(a type of water quality meter) were placed directly in the water to measure DO, turbidity, temperature and pH data. Water samples for laboratory analysis were collected in clean, unused, sample containers provided by the laboratory. After sample collection, the container was labeled and immediately placed in an ice-filled cooler for transport to the laboratory.

2.2. Analytical Methods

Samples were analyzed by two different laboratories during the 2008 monitoring period. Timpview Analytical Laboratory in Orem, Utah,was used for the April 2008, May 2008, and August 2008 samples. Chemtech-Ford Laboratories in Murray, Utah, was used for the remaining samples collected in September 2008, November 2008, and January 2009. The change in laboratories was primarily because of the short holding time required for bacteria analysis and the sample transit time to Chemtech-Ford could be reduced by 1hour. All samples were analyzed using standard U.S. Environmental Protection Agency (EPA) and American Public Health Association (APHA) methods (Table 1).

Table 1. PacifiCorp Water Quality Monitoring Parameters and Analytical Methods (1996–2008)

Parameter	Analysis Type	Methods Used in Previous Years	Methods used in 2008	
		ERI	Chemtech-Ford Laboratories	Timpview Analytical Laboratories
Total Coliform	Total	NELAP approved	SM 9223B	SM 9223B
Fecal Coliform	Total	NELAP approved	SM 9223B	SM 9223B
Escherichia coli (*E. coli*)	Total	SM 9223B	SM 9223B	SM 9223B
Nitrogen, ammonia as N	Total	EPA Method No. 350.3	SM 4500G	SM 4500B,E

Table 1. PacifiCorp Water Quality Monitoring Parameters and Analytical Methods (1996–2008)

Parameter	Analysis Type	Methods Used in Previous Years	Methods used in 2008	
		ERI	Chemtech-Ford Laboratories	Timpview Analytical Laboratories
Nitrogen, Nitrate (NO3) as NO3	Total	EPA Method No. 353.3	EPA Method No. 300	EPA Method No. 352.1
Nitrogen, Nitrite (NO2) as NO2	Total	EPA Method No. 354.1	EPA Method No. 354.1	EPA Method No. 354.1
Phosphorus as P	Total	EPA Method No. 365.2	SM 4500B, E	SM 4500 B,E
Phosphorus, orthophosphate as P	Dissolved	EPA Method No. 365.2	SM 4500E	EPA Method No. 361.5
Solids, Total Dissolved (TDS)	Dissolved	N/A	SM 2540C	SM 2540C
Solids, Total Suspended (TSS)	Total	EPA Method No. 160.2	SM 2540D	SM 2540D

Note: N/A = Not Applicable; NELAP = National Environmental Laboratory Accreditation Program

2.3. Data Handling

2.3.1. Quality Assurance and Quality Control

The precision of the data was assessed to ensure data were of sufficient quality for purposes of this analysis. The precision, or reproducibility, of field samples and field sample duplicates (field sampling precision) was evaluated based on relative percent difference (RPD):

$$\mathrm{RPD} = \frac{(D_1 - D_2)}{(D_1 + D_2)\,/\,2} \times 100$$

where D_1 is the first duplicate field sample value and D_2 is the second duplicate field sample value. For field duplicates, a calculated RPD of greater than ± 20% was deemed unacceptable, and the results were excluded from analysis.

At least one duplicate sample was collected for quality assurance/quality control (QA/QC) purposes during each sampling event from 2000 to 2003 and in 2008. Basic descriptive statistical analyses used for data characterization consisted of the number of data points; mean, median, maximum, and minimum values; hydroperiod, and seasonality (Appendix A). In 2008, 87 paired field sample duplicates were collected and compared as part of QA/QC efforts to evaluate data precision. Less than 5% of duplicate measurements exceeded the RPD criteria of ± 20%. Four duplicate sample values (for ammonia, nitrate, and TSS) had a greater than ±20% RPD from the original values. All other duplicate values were within the ±20% RPD criteria. Of the four duplicate sample values greater than ±20% RPD from their paired measurements, three were below detection limits (non-detects) and the duplicate sample values within detection limits were used for analysis. The excluded duplicate samples included two non-detect measurements for nitrate and one non-detect for ammonia. Only one duplicate sample value was greater than 20% RPD from the original value and within detection limits. For this sample (TSS measurement for Station 4903400 on September 25, 2008), both the original and duplicate measures for this parameter were excluded from analysis.

2.3.2. Non-detect Treatment

Several analytical results for total phosphorus, orthophosphate, ammonia, nitrate, nitrite, and fecal coliform, were identified asbelow detection limits. In cases where the result was reported as below detection limits, a value of one-half the detection limit was used in the data analysis. Using values of half the detection limit is common practice because values of zero may underestimate the true concentration, while values of the detection limit itself may over-estimate the true concentration. Non-detect entries accounted for a total of 62 data points representing 3% of the total dataset.

2.3.3. Treatment of Outliers

To identify non-representative data or outliers in the dataset, a threshold of plus or minus three standard deviations from the mean was applied to all of the datasets collected by PacifiCorp to determine those data that should be excluded from the analysis. A threshold of plus or minus three standard deviations is often applied to identify outliers in environmental data.Using this methodology, only data associated with field measurements and/or pathogen sampling (total and fecal coliform) indicated outliers. The natural variability of these parameters is well known and for this reason the data were not excluded from the analysis.

2.4. Seasonal Coverage

Water quality monitoring was completed from 1996 through 1998, 2000 through 2003, and again in 2008. In general, sampleswere collected quarterly; however prior to 2008, samples were not collected during several sampling seasons (Table 2). In past years, coverage was generally better during winter, spring, and fall months. Physical water quality characteristics (e.g. DO, turbidity, temperature and pH concentrations) measured during all monitoring events for a particular season is assumed to be representative of season-specific watershed conditions.

Table 2. Water Quality Sampling Over Time

Sampling Cycle	Year	Winter			Spring			Summer			Fall		
		Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
1996–1998	1996												X
	1997	X			X						X		
	1998					X				X		X	
2000–2003	2000	X									X		
	2001			X			X						
	2003	X		X				X			X		
2008–2009	2008					SR	BF			BF	BF		ST
	2009		BF										

X = sampled (likely during baseflowconditions); BF = baseflow; ST = storm; SR = spring runoff

2.5. HydrologicCoverage

The Bear River/Cutler Reservoir hydrologic system is highly modified.Flow patterns observed in the Bear Riverare influenced by impoundments and diversions upstream of Cutler Reservoir. These structures reshape the hydrograph, decreasing the intensity and increasing the duration of spring runoff flows, while extending summer flows.

The Bear River represents the majority of the water flowing into Cutler Reservoir at 75% of theannual average inflow. The LoganRiver supplies 17% of the average annual flow to Cutler Reservoir while the Little Bear River and Spring Creek supply 3% and 2%,respectively. These three tributaries supply the majority of flow to Cutler Reservoir.

Discharge data for Cutler Reservoir are available on the Bear River below Cutler Reservoir during this period as well as flow data collected by the U.S. Geological Survey along the Bear River near the Utah–Idaho state line. A hydrograph of these discharges is provided in Figure 1. Hydrologic data for the Cutler Reservoir system provide one explanation for the patterns in water quality data.

The water quality monitoring program established by PacifiCorp for the Cutler Reservoir system provides good distribution of water quality data across space and time. To better examine seasonal and temporal trends, 2008 water quality sampling were also tied to hydrologic events. This is especially important in a water quality sampling program that relies on grab samples collected during specific times of the year. Although sampling during hydrologic events introduces a level of uncertainty into the sampling procedure, the resulting water quality analyses are more easily compared across time and allow for a more nuanced understanding of parameter changes as a result of typical hydrologic conditions in the Cutler Reservoir system.

To maintain the quarterly sampling plan established by PacifiCorp, seasonal samples were collected during winter, spring, summer, and fall. Additionally, samples were collected during baseflow conditions (defined by at least 3 dry days). Spring baseflow samples (May 24, 2008) were taken prior to irrigation, while summer baseflow samples (August 1, 2008) were taken during irrigation activity. Fall baseflow samples (September 25, 2008) were taken following peak irrigation activity. In addition, water quality samples were collected during a fall storm (November 2, 2008) as well as the peak of spring melt runoff (April 24, 2008; see Figure 1). The fall storm resulted in 0.5 inch of rainfall. The spring runoff event was determined bybasin status and was captured on the rising side of the spring hydrograph. The spring baseflow sample, although labeled baseflow, also represents conditions immediately following spring melt in late May 2008. No summer storms were captured in 2008 sampling efforts, preventing inclusion in resulting hydroperiod analyses.

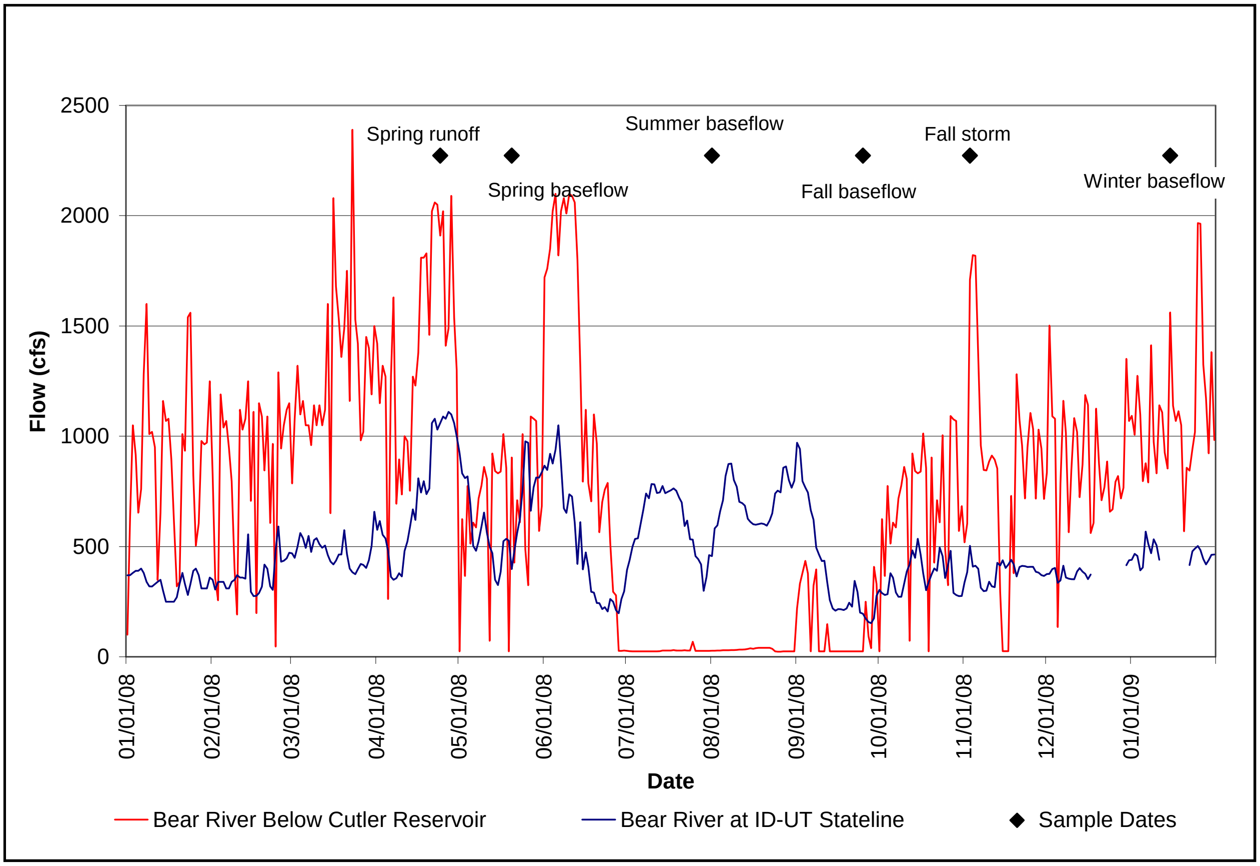

Figure 1. Bear River hydrograph for 2008.

2.6. Spatial Coverage

In past sampling periods, water quality samples were collected from Cutler Reservoir at Benson Marina, from fourtributary sites entering the reservoir (Logan River, Little Bear River, Spring Creek, and Bear River), and at the Bear River below the reservoir dam. In 2008, two additional reservoir monitoring sites were added; one in the northern section of the reservoir (near Highway 23) and one in the southern section of the reservoir, above the confluence with Swift Slough. These sites were added to assess the influence of the southern reservoir and the Bear River on water quality in the northern reservoir. The sampling location at Swift Slough was added to evaluate the water quality influence of Swift Slough from the other tributaries in the southern reservoir. Unfortunately, weather conditions and boat access prevented sample collection from the Swift Sough site during all sampling events except in September 2008. All sampling sites are shown on Figure 2 and listed in Table 3.

Table 3. Summary of Sampling Sites around Cutler Reservoir

Site ID	Site Name	Site Key	Segment Location
4901980	Bear River below Cutler Reservoir at UP&L Bridge	Bear Riverbl/dam	Cutler Reservoir outflow
4903400	Bear Riverbelow confluence with Summit Creek	Bear RiveratSummit Creek	Bear River
4904900	Spring Creek at CR 376 (Mendon) Crossing	Spring Creek	Southern tributary
4905000	Little Bear River at CR376 (Mendon) Crossing	Little Bear River	Southern tributary

Table 3. Summary of Sampling Sites around Cutler Reservoir

Site ID	Site Name	Site Key	Segment Location
4905040	Logan River above confluence with Little Bear River at CR376 Crossing	LoganRiver	Southern tributary
5901000	Cutler Reservoir at BensonMarinaBridge	Cutler Reservoir at Benson Marina	Southern reservoir
5900980	Cutler Reservoir at Highway 23 Bridge	Cutler Reservoir at Hwy 23	Northern reservoir
PacifiCorp1	Cutler Reservoir south of Swift Slough near Island	Cutler Reservoir at Swift Slough	Southern reservoir

Note: Numbered sites correspond to Utah Division of Environmental Quality monitoring sites.

2.7. Uncertainty Analysis

Water quality monitoring data are primarily used to detect the status and trends in a given water body, and to identify whether observed trends are from natural or anthropogenic causes. Identifying data uncertainty is essential to assess the reliability of waterquality analyses and resulting predictions (Rode and Suhr 2007). Uncertainty in the data presented in this summary is derived from several sources. Sampling uncertainties include effects from sampling methods, location, and the parameter being sampled. For the data presented here, there is some uncertainty due to the possibility that ERI (previous water quality sampling contractor) and SWCA used different field equipment. Measurement and analytical uncertainties are less problematic, as instrument quality can be assessed in field and laboratory settings. Nevertheless, analytical errors can contribute considerably to the overall uncertainty of waterqualitydata (Rode and Suhr 2007). In most cases variation of analytical errors between approved analytical methods are small (Rode and Suhr 2007). However, samples have been analyzed by multiple labs. ERI labs analyzed water quality samples in the 1990s and in 2003. ERI personnel that worked directly on the previous datasets have left the company and therefore some assumptions had to be made regarding these data. In 2008, samples were analyzed by Timpview Analytical Laboratory in Orem, Utah,and Chemtech-Ford Laboratories in Murray, Utah. Timpview was used for the April 2008, May 2008, and August 2008 samples in the beginning of 2008, and Chem-Tech was used for the remaining 2008 samples. We assumed that the ERI lab is State certified and followed NELAP procedures. Additional uncertainty is due to the possibility that different analysis methods (EPA v. Standard Methods) were used for TSS, phosphorus (total phosphorus [TP], orthophosphate) and ammonia. We also assumed that the ERI data are representative of seasonal baseflow conditions. Finally, we assumed that fecal coliform was calculated from *Escherichia coli* (*E. coli*)for all samples, where the enzyme substrate assay for measuring total coliforms and *E. coli* (9223B Enzyme Substrate Test) was used to measure *E. coli* and fecal coliform calculated from the result. In addition to the sampling, measurement, and analytical uncertainties, it is important to note that there is inherent uncertainty associated with a complex system like Cutler Reservoir.

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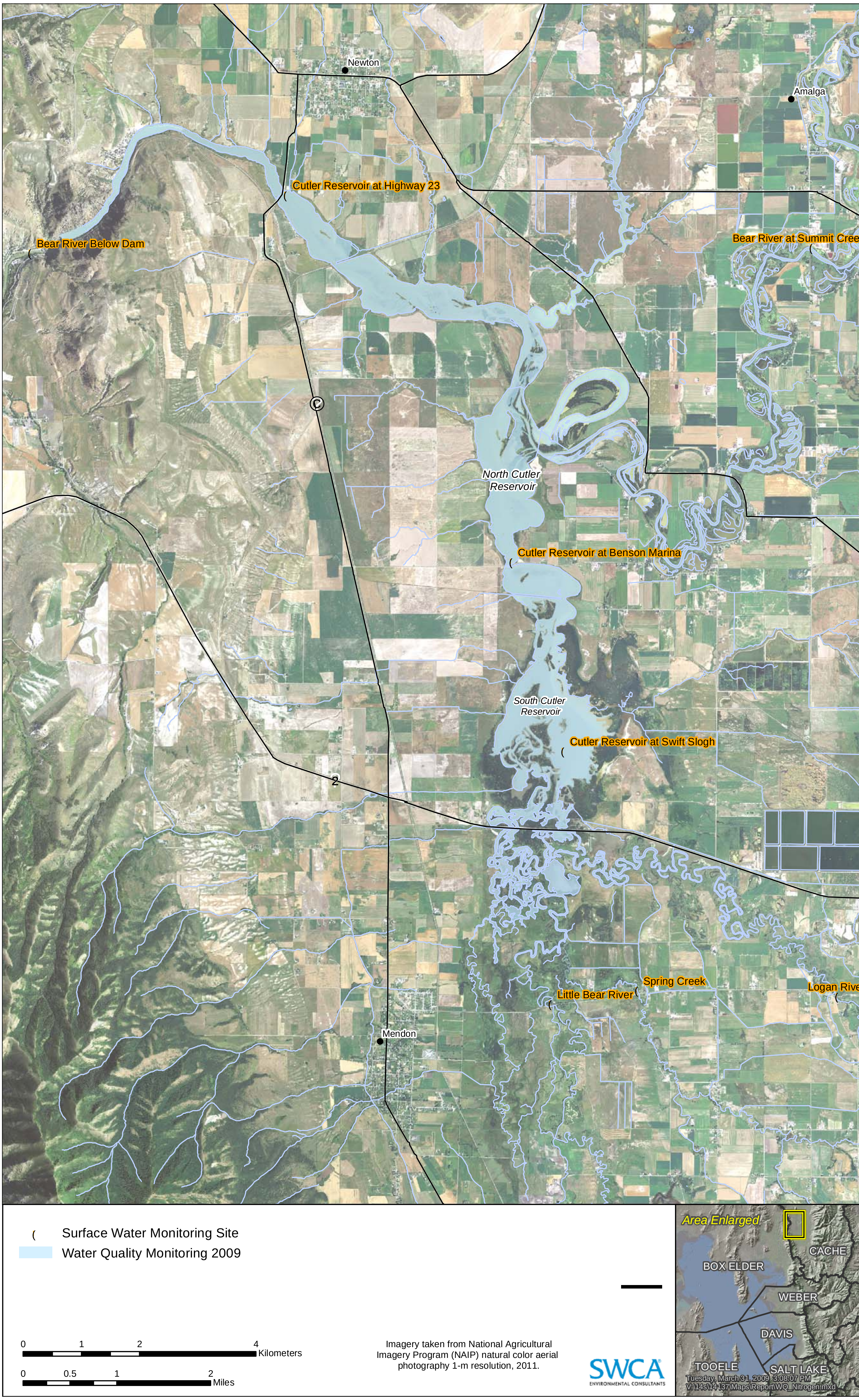

Figure 2. Cutler Reservoir surface water monitoring sites.

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3. WATERSHED HYDROLOGY

The PacifiCorp water quality monitoring data were collected over a wide range of hydrologic conditions in the watershed. The most notable changes in the hydrologicconditions of Cutler Reservoir are evident in the releases from the reservoir throughout the entire monitoring period (1996 to 2008) as compared to releases during each monitoring event (Table 4).

During the 1996 to 1998 monitoring event, annual releases from the reservoir were 167% greater than the entire monitoring period average, signaling wet years. Conversely, during the 2000 to 2003 monitoring event, reservoir releases were 45% of the entire monitoring period average, signaling dry years (see Table 4; Figure 3). During the 1996 to 1998 wet years, the spring season carried the most flow (3,372 cubic feet per second [cfs]) with the remaining flows distributed relatively evenly throughout the rest of the year. However, during the 2000 to 2003 dry years, the winter and spring seasons accounted for the most discharge. In 2008, flows were slightly higher than the 2000 to 2003 period, but still 59% of the average flow for the entire period. The highest flow in 2008 occurred during the spring season. The reservoir is operated in run-of-river mode such that water surface elevation is maintained between 4,406.25 feet and 4,407.75 feet from March 1 through December 1 and from 4,405.5 to 4,407.75 from December 2 through February 28. These ranges are required by PacifiCorp’s FERC license filed in 1999 and supplemented in 2002.

Table 4. Cutler Reservoir Releases by Monitoring Event and Season

Monitoring Event	Annual	Winter	Spring	Summer	Fall
1996 to 2008 (Entire Period)					
Average Daily Discharge (cfs)	1,176	1,181	2,075	684	759
1996 to 1998					
Average Daily Discharge (cfs)	1,959	1,662	3,372	1,666	1,123
% of Average	167%	141%	163%	244%	148%
2000 to 2003					
Average Daily Discharge (cfs)	534	852	794	48	447
% of Average Water Year	45%	72%	38%	7%	59%
2006 to 2008					
Average Daily Discharge (cfs)	1,009	1,113	1,971	281	671
% of Average	86%	94%	95%	41%	88%
2008					
Average Daily Discharge (cfs)	699	841	1,123	414	417
% of Average	59%	71%	54%	60%	55%

The average daily discharges from Cutler Reservoir areshown for each monitoring event on the hydrographsin Figure 3.As described above, releases from Cutler Reservoir during the 1996 to 1998 monitoring event are characterized by wet conditions and high flows, while the 2000 to 2003 monitoring event is characterized by dry conditions with low flows. The 2008 water year was also a relatively low flow year, although when grouped with the preceding 2 water years (2006 and 2007) the period shows average water releases from Cutler Reservoir. The years identified as wet versus dry years, based on discharge from Cutler Reservoir, are paired with the annual flow in the Bear River above Cutler Reservoir at the Utah–Idaho state line. Based on flow at the Utah–Idaho state line in the past 10 years, the water years of 1997, 1998, and 1999 have been the wettest years. Prior to the last decade, wetter years occurred in 1983, 1984, and 1986. Since 1971, the driest years have been 2002, 2003, and 2004.

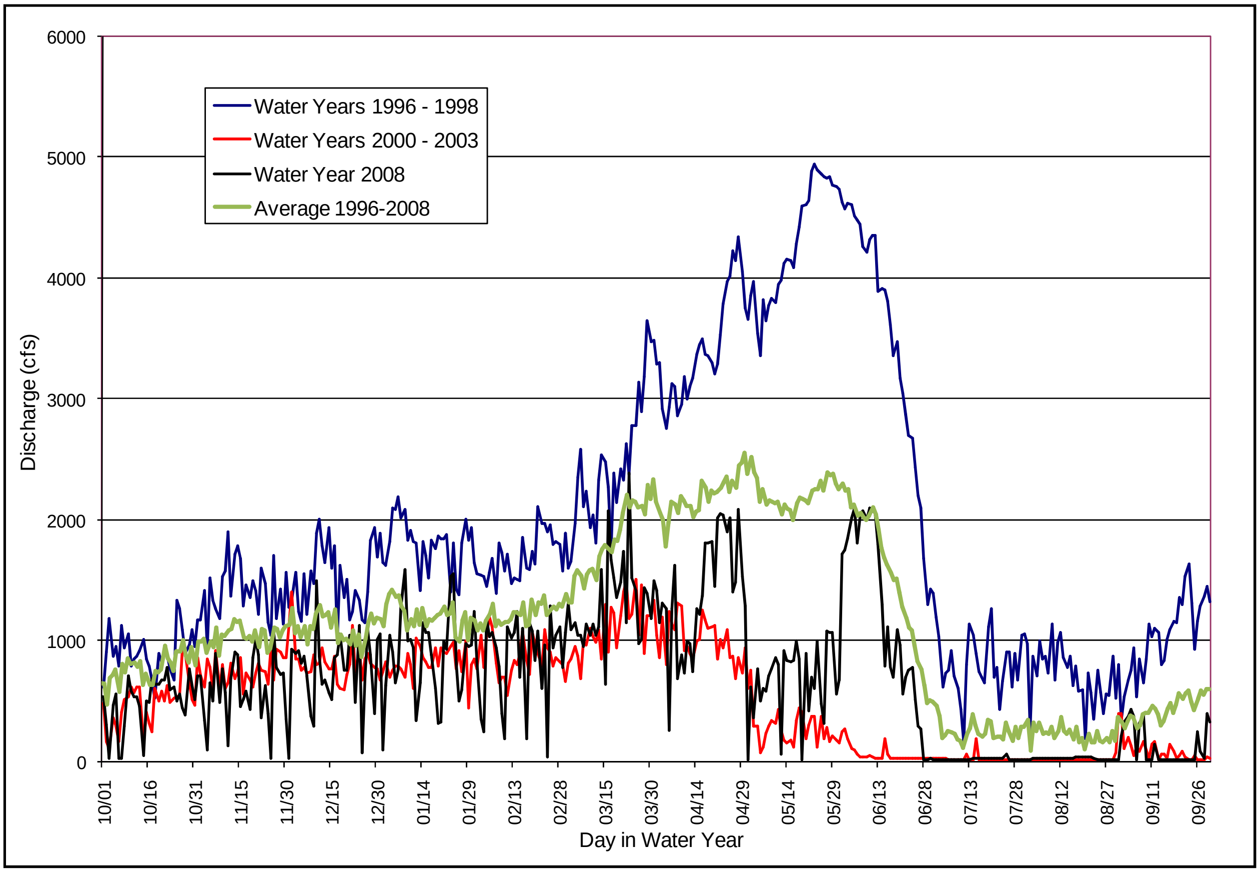


Figure 3. Hydrograph for average daily releases from Cutler Reservoir (cfs) during three monitoring periods.

Bear River flows in 2006, 2007, and 2008 were 70%, 57%, and 47% of the average 30-year flow of 1,035 cfs, respectively. This recent trend in low flow is indicative of drought and dry conditions that could influence water quality by reduced flushing and dilution.The hydrographs for releases from Cutler Reservoir show an annual trend of increasing water delivery rates during the summer and a general decrease of water releases throughout the late summer and fall. This reflects the reduced delivery of irrigation water to the reservoir from the watershed during the dry part of the season.This seasonal pattern tends to replicate itself over the monitoring period. The water release tends to change dramatically during drought years (2000–2003) which reflects both the reduced water delivery to the reservoir and PacifiCorp's maintenance of reservoir water levels even during dry seasons. The water year 2000 hydrograph did not demonstrate the normal late fall/early spring gradual average water discharge that is present within the other years of the hydrographs.

It is noteworthy that a faulty seal on an irrigation canal headgate allowed 50 cfsto flow continuously throughout the 2007–2008 winter season. Therefore, in November 2008, Cutler Reservoir was drawn down to allow repairs to the gate, after whichthe reservoir was restored to normal elevations (Figure 4). PacifiCorp personnel inspected the reservoir during the drawn-down condition; however, no aerial photography or bathymetric data are available to document the reservoir bed condition. The drawdown exposed the usually inundated Wheelon Dam in Cutler Canyon a short distance upstream of Cutler Dam.

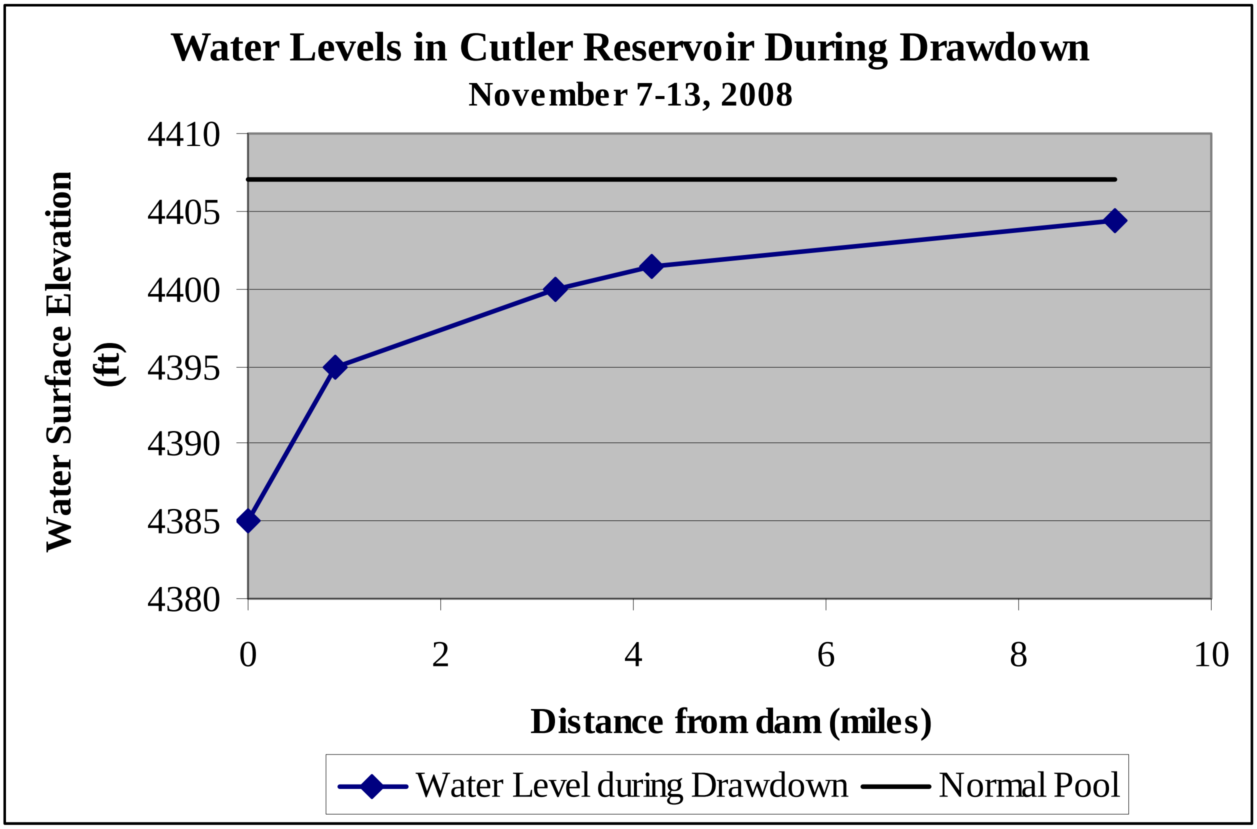


Figure 4. Water levels in Cutler Reservoir during drawdown, November 2008.Graphic source: Connely Baldwin, PacifiCorp

4. WATER QUALITY RESULTS

4.1. Temperature

Water temperature determines whether or not a water body can support warm- or cold-water aquatic species. High water temperatures can be harmful to fish at all life stages, especially if they occur in combination with other habitat limitations such as low DO or poor food supply. Elevated water temperatures can result in lower body weight, poor oxygen exchange, and reduced reproductive capacity of adult fish. Extremely high temperatures can result in death if they persist for an extended length of time. Juvenile fish are more sensitive to temperature variations and duration than adult fish and can experience negative impacts at a lower threshold value than the adults. Temperature is an important indicator of water and wetland habitat quality. Water temperature is affected by vegetative cover, thermal inputs, flow alterations, ambient air temperatures, groundwater recharge, and direct sunlight. Average annual temperatures in the Cutler Reservoir system were consistently higher across sampling sites during the 2008 monitoring period as compared to previous years (Table 5).

Table 5. Temperature (°C) in the Cutler Reservoir System from 1996 to 2008

	Spring Baseflow	Spring Runoff	Summer Baseflow	Fall Baseflow	Fall Storm	Winter Baseflow	Annual Average	Annual Max	Annual Min	Annual Standard Deviation
1996–1998										
LoganRiver	5.2		13.3	7.9		5.0	7.5	13.3	3.3	3.4
Little Bear River	5.4		17.2	9.8		7.1	9.2	17.2	3.0	4.8
Spring Creek	6.8		18.1	9.5		6.1	9.5	18.1	4.2	4.8
Cutler Reservoir at Benson Marina	7.2		27.5	10.9		7.2	11.7	27.5	4.7	8.3
Bear River at Summit Creek	5.4		23.3	9.8		5.9	9.9	23.3	3.3	7.3
Bear River below dam	5.8		24.2	10.3		5.9	10.4	24.2	3.5	7.4
2000–2003										
LoganRiver	10.8		11.9	14.1		2.7	7.7	14.5	1.8	5.5
Little Bear River	15.9		20.2	15.1		2.6	9.6	20.2	1.7	7.7
Spring Creek	15.7		18.2	14.4		3.9	9.8	18.2	3.1	6.4
Cutler Reservoir at Benson Marina	21.5		21.2	20.7		1.8	11.4	21.5	0.3	10.3
Bear River at Summit Creek	17.8		20.9	17.9		1.0	9.8	20.9	–	9.5
Bear River below dam	20.8		22.0	19.5		2.2	11.3	22.0	1.2	9.9
2008										
LoganRiver	9.9	7.0	17.3	10.9	9.7	2.5	9.5	17.3	2.5	4.9
Little Bear River	17.4	6.9	19.7	11.4	10.7	1.3	11.2	19.7	1.3	6.7
Spring Creek	17.4	8.5	20.1	12.1	11.1	3.2	12.0	20.1	3.2	6.1
Cutler Reservoir south of Swift Slough	–	–	–	14.1	–	–	14.1	14.1	14.1	–
Cutler Reservoir at Benson Marina	20.0	9.4	24.9	15.2	11.0	0.9	13.6	24.9	0.9	8.4
Bear River at Summit Creek	15.5	8.5	23.3	14.6	10.6	0.9	12.2	23.3	0.9	7.5
Cutler Reservoir at Hwy 23	19.0	9.3	24.9	16.0	10.9		16.0	24.9	9.3	6.3
Bear River below dam	18.4	10.0	27.0	17.5	10.6	0.1	13.9	27.0	0.1	9.2

The Logan River was, as expected, the coolest of the sites sampled across all monitoring periods, as it represents the most intact riparian habitat in the study area and directly drains a high-elevation watershed. The warmest water temperatures occurred in the middle to northern part of Cutler Reservoir and the Bear River, a slow-moving valley river with a lower percentage of riparian cover.The small (2%) percent of temperature exceedance of the State standard of 27^{o}C for warm-water fisheries incidents that took place from 1996 to 2008 occurred during summer months at these two sites.

Temperature values also, as expected, fluctuatedby season and by hydroperiodthroughout the Cutler Reservoir system. Hydroperiod results suggest that 2008 temperatures generally ranged between higher 2000 to 2003 temperatures occurring during drought conditions and lower 1996 to 1998 temperaturesoccurring during periods of higher flow. Seasonal temperature variations followed a similar pattern, although they did not reflect the drop in temperature that occurred across sites following spring runoff and fall storm events in 2008.

4.2. pH

The pH of a water body is a measure of its acidity or alkalinity. A pH value of 7 is neutral, values 0 to 7 are acidic, and 7 to 14 are alkaline. Extremely acidic or alkaline waters can be problematic to fisheries. Extreme levels of pH can be directly toxic to aquatic life. Each species of fish has a distinct range of pH preference, and levels outside of this range will cause health problems such as damage to skin, gills, and eyes. Prolonged exposure to these conditions can cause stress, increase mucus production, and encourage thickening of the skin or gill epithelia, sometimes with fatal consequences. Substantial diurnal shifts in pH that result mainly from photosynthesis are stressful and damaging to the health of aquatic organisms. Changes in pH also affect the toxicity and availability of dissolved compounds such as heavy metals.Measured pH values in the 6.5 to 9.0 range are generally supportive of aquatic life (Utah Water Quality Standards, Rule R317-2-14).

The pH values observed in the Cutler Reservoir system are generally slightly basic (alkaline) across time and sampling locations (Table 6). Approximately 5% of 2008 pH samples slightly exceeded the pH threshold of 9.0. pH threshold exceedanceswere recorded in previous years' findings and may represent a change in the reservoir system.The possible causes of increased pH in the reservoir are unknown. Additional monitoring of pH should be conducted to confirm whether this pattern persists. Two-thirds of exceedanceswere in Cutler Reservoir, particularly at the site east ofHighway 23, whereas the other two exceedances were within the Bear River and the Logan River. Minimal pH changes were observed across seasons and hydroperiods. Spring runoff events in 2008 did slightly increase pH values relative to spring baseflow conditions, while pH remained steady across fall storms and other seasonal baseflow levels.

Table 6. Change in pH in the Cutler Reservoir System from 1996 to 2008

	Spring Baseflow	Spring Runoff	Summer Baseflow	Fall Baseflow	Fall Storm	Winter Baseflow	Annual Average	Annual Max	Annual Min	Annual Standard Deviation
1996–1998										
LoganRiver	7.7		7.9	8.2		7.8	8.0	8.3	7.5	0.3
Little Bear River	8.0		7.7	8.1		8.2	8.0	8.2	7.7	0.2
Spring Creek	7.7		7.6	8.0		8.0	7.9	8.1	7.6	0.2
Cutler Reservoir at Benson Marina	8.2		8.4	8.3		8.4	8.3	8.4	8.0	0.2
Bear River at Summit Creek	8.0		8.0	8.2		8.3	8.1	8.3	7.9	0.2
Bear River below dam	8.0		8.0	8.2		8.3	8.1	8.3	7.9	0.2
2000–2003										
LoganRiver	8.1		8.1	7.8		8.2	8.1	8.3	7.6	0.2
Little Bear River	8.0		7.8	7.9		8.1	8.0	8.3	7.8	0.2
Spring Creek	7.8		7.8	7.6		8.0	7.9	8.1	7.6	0.2
Cutler Reservoir at Benson Marina	8.3		8.4	8.5		8.1	8.2	8.7	7.7	0.3
Bear River at Summit Creek	8.1		7.9	7.9		8.1	8.0	8.4	7.7	0.3
Bear River below dam	8.1		7.9	7.9		8.1	8.0	8.4	7.7	0.3

Table 6. Change in pH in the Cutler Reservoir System from 1996 to 2008

	Spring Baseflow	Spring Runoff	Summer Baseflow	Fall Baseflow	Fall Storm	Winter Baseflow	Annual Average	Annual Max	Annual Min	Annual Standard Deviation
2008										
LoganRiver	8.7	8.7		8.5	8.0	–	8.5	8.7	8.0	0.3
Little Bear River	8.5	8.8	8.8	8.4	7.9	–	8.5	8.8	7.9	0.3
Spring Creek	8.5	8.7	8.7	8.4	7.8	–	8.4	8.7	7.8	0.3
Cutler Reservoir south of Swift Slough	–	–	–	8.9	–	–	8.9	8.9	8.9	–
Cutler Reservoir at Benson Marina	8.8	8.9	9.2	8.5	8.4	–	8.8	9.2	8.4	0.3
Bear River at Summit Creek	8.8	8.8	9.1	8.8	8.3	–	8.7	9.1	8.3	0.3
Cutler Reservoir at Hwy 23	9.0	8.9	9.0	9.1	8.5	–	8.9	9.1	8.5	0.2
Bear River below dam	8.5	8.8	8.5	9.0	8.5	–	8.6	9.0	8.5	0.2

4.3. Coliform Bacteria

Pathogenic organisms known to be waterborne include bacteria (e.g., dysentery), viruses (e.g., hepatitis), protists (e.g., *Giardia*), and parasites. Some pathogens and indicator bacteria can live in bottom sediments of streams and be resuspended during high flows. Pathogenic organisms are costly and difficult to test for in natural waters due to their low concentrations and diversity.

Fecal coliforms are common bacteria found in the digestive tracts of warm-blooded animals including humans, mammals (wildlife and livestock), and birds. Fecal coliforms are not harmful themselves but are a good indicator of fecal contamination of waters, which is a public health risk due to the possible presence of pathogenic organisms harmful to humans. Coliform bacteria serve as an indicator of contamination of a water body with fecal material. Although coliform bacteria themselves do not cause disease, they are in much higher abundance and easier to sample than disease-causing microorganisms, and therefore are good indicators of the presence of pathogens from the same fecal source.High concentrations of coliform bacteria in surface waters indicateimproper animal or human waste disposal, as well as improper grazing or livestock management practices, and can result in health risks to individuals using the water for recreation or other activities.

*Escherichia coli*is one species of fecal coliform that can also be used as an indicator of fecal contamination. The majority of *E. coli* strains are not pathogenic to humans (Nataro and Kaper 1998). However, some strains of *E. coli*, such as *E. coli* 157:H7, are responsible for hemorrhagic colitis (severe diarrhea) and hemolytic uremic syndrome (kidney failure) (Nataro and Kaper 1998), both of which cause mild to extreme symptoms in humans and can be fatal if left untreated. *E. coli* has recently been found to be a more reliable indicator of pathogens originating from fecal matter than fecal coliforms.In 1986, the EPA recommended that *E. coli* or enterococci replace fecal-coliform bacteria in state water-quality standards (EPA 1986). The EPA's recommendation for *E. coli*as an indicator of fecal contamination in water and wastewater is because 1) *E. coli* occurs in human and warm-blooded animal feces in greater quantities than pathogens; 2) it shows minimal growth in aquatic systems; 3) it is easily detectable; and 4) it is consistently present when pathogens are present (Elmund et al. 1999).

Based on the previous coliform standards established by the State of Utah in assessing water quality, high total coliform and fecal coliform values are those greater than 5,000 and 200 coliform-forming unitsper 100 mL (cfus/100 mL), respectively.The new pathogen standard for the State of Utah relates to *E. coli* and requires water bodies designated for secondary recreation (Cutler Reservoir) not to exceed *E. coli* values of 668 cfus/100 mL. The 30-day standard for the same waters is a geometric mean of *E. coli*not to exceed 206 cfus/100 mL.

There are noteworthy differences for coliform bacteria and *E. coli*in the Cutler Reservoir system between monitoring periods, season, and hydroperiod. These differences are discussed in the sections that follow. Fecal coliform data reported for 2008 (with the exception of April 2008 and August 2008) were measured as *E. coli* and converted to fecal coliform using a standard conversion factor of 1.59 identified by the Utah Division of Water Quality (UDWQ 2005). Collection of *E. coli* data is recommended for future monitoring periods in order to assess compliance with new state water quality criteria.

4.3.1. Coliform Differences between Monitoring Periods

A comparison of coliform bacteria (for baseflow samples only) across the three monitoring periods suggests that fecal coliform and total coliform concentrations generally decreased from the first monitoring period (1996–1998) to the second monitoring period (2000–2003), and then increased to or above 1996–1998 concentrations in the 2008 samples(Figure5). The comparison is for baseflow samples only so that the comparison between monitoring periods is based on similar conditions. The spike in total and fecal coliforms in 2008 could be related to hydrological conditions. Water year 2008 was relatively dry compared to the 2 years prior. Wet years can result in more washoff of coliforms that can reside in open water systems and be remobilized for several years. The lack of dilution in 2008 may have contributed to these peaks. However, peak concentrations during baseflow conditions often indicate contributions from a point source that discharges continuously and is therefore not related to the surface runoff processes that drive nonpoint source contributions. The two largest point source dischargers near Cutler Reservoir are the Logan Regional Wastewater Treatment Plant on Swift Slough and the EA Miller packing plant on Spring Creek. The peaks may also simply be a result of different laboratories used in the earlier monitoring periods compared to the 2008 monitoring period.The high concentration of coliforms in the Logan River is especially noteworthy, as this site has historically had the best water quality. Agricultural operations in the lower portion of the Logan River could explain the increases if land and/or animal management changed between 2003 and 2008. Future water quality monitoring (including pathogens) of the Logan River by the UDWQ could help to determine whether this is a concerning trend.

Fecal coliform concentrations were, on average, higher in southern reservoir and tributary sites than in the Bear River and at the northern reservoir sampling location.Total coliform values were high across the system during the 2008 monitoring season. Concentrations of fecal coliform bacteria also exceeded the previous State of Utah standard of 200 cfus/100 mL threshold in 14% to 71% of samples taken across all monitoring periods, despite the observed reduction that occurred from 2000–2003. In particular, the sampling locations of Spring Creek and the Little Bear River had the highest percentage of exceedances. The only exceedances of the total coliform standard occurred during the first sampling period of 1996–1998 at Benson Marina.

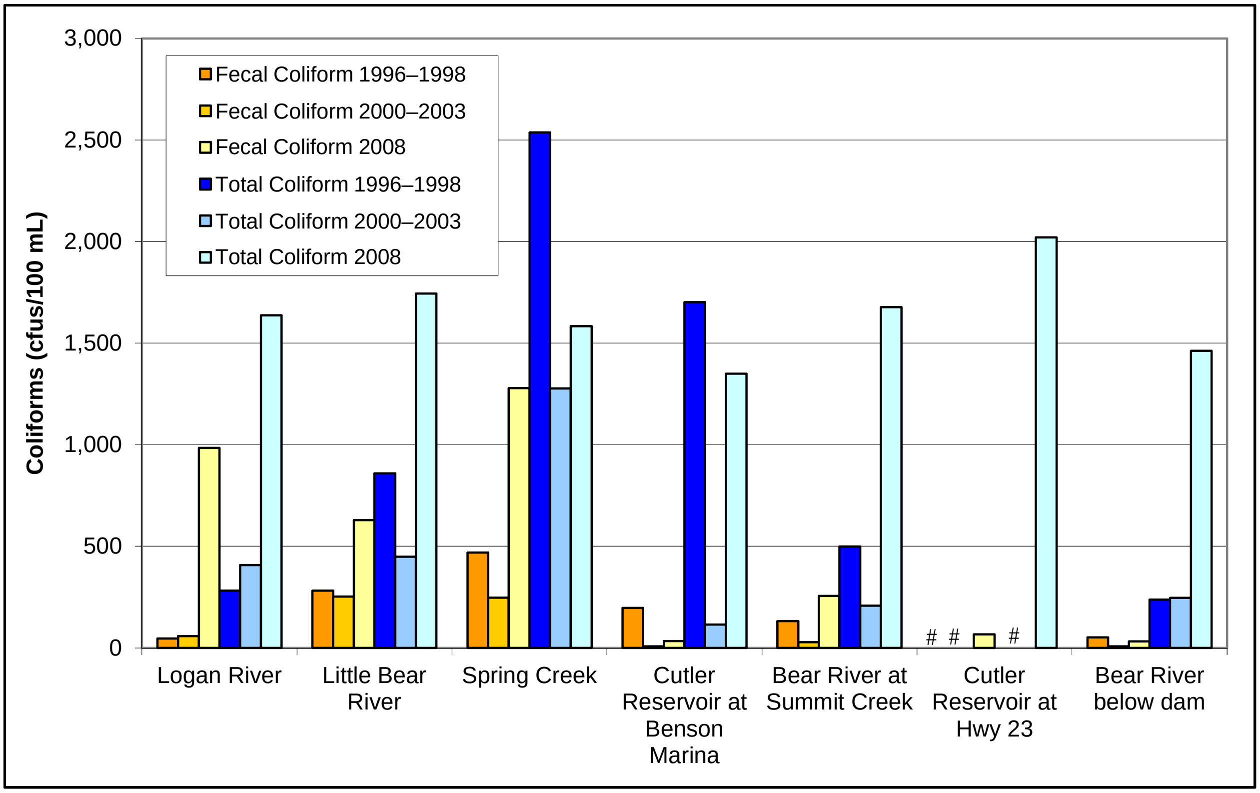


Figure 5. Change in fecal coliform bacteria in Cutler Reservoir system during baseflow periods between 1996 and 2008.

4.3.2. Seasonal Variation of Coliform Bacteria

In general, total and fecal coliform concentrations were the highest during spring and summer baseflow conditions and lowest during winter baseflow conditions. This trend is expected since surface runoff, the process that transports coliform bacteria to surface waters, is generally not a significant contributor to flow during the winterand because temperature affects the survivability of coliform bacteria (Figure6).The spring runoff period showed relatively low fecal coliform concentrations, indicating that animal activity on the landscape during winter months is not a significant source of coliform bacteria either because animals are contained during this time, or because cold temperatures reduce the survival of the bacteria. Washoff during the spring melt period may have affected the spring baseflow sample that captured the period following spring runoff in late May 2008.

More surprising were the relatively low fecal coliform data collected during the fall storm event. Storms typically wash pollutants and bacteria off the landscape that have accumulated over a period of dry conditions. Additional storm sampling in the future would help determine whether low washoff occurs in the Cutler Reservoir watershed or whether the storm captured by these data—November 2, 2008—was too small (0.5 inch) to cause significant washoff.

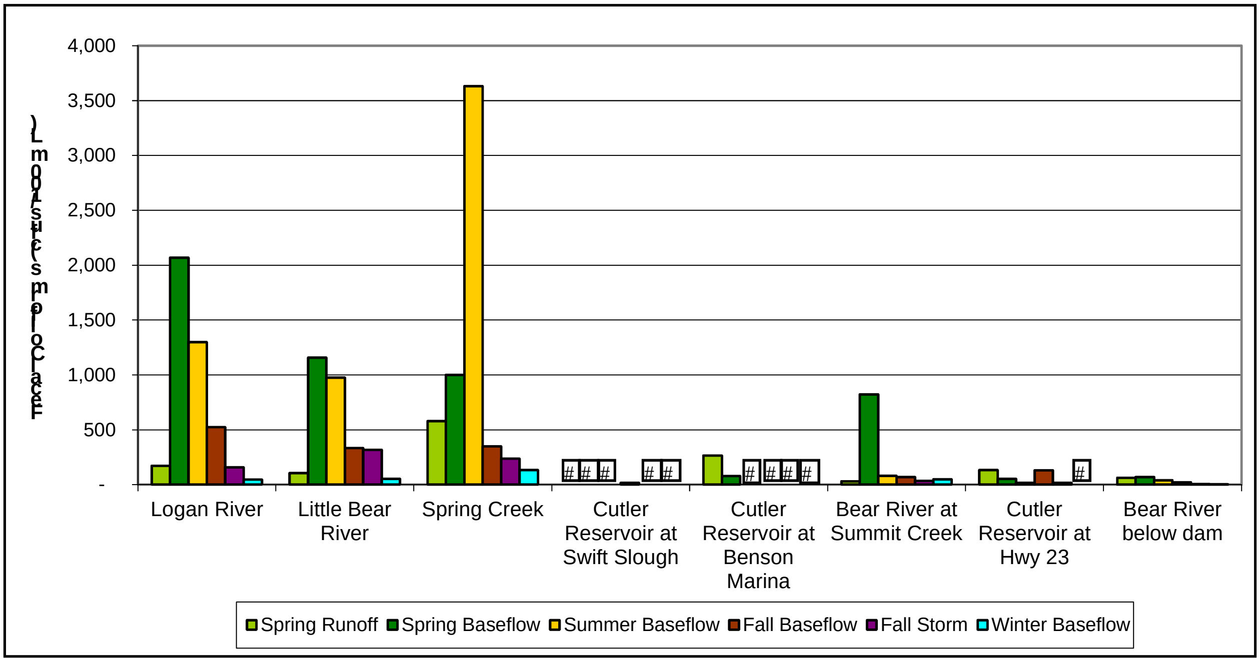


Figure 6. Fecal coliform bacteria (cfus/100 mL) for sampling sites by 2008 hydroperiod.

Note: Only one sample (fall baseflow) of six was collected for the Cutler Reservoir at Swift Slough site.

4.4. Nutrients

Concerns associated with excessive nutrient concentrations in freshwaters relate to both direct and indirect effects. Direct effects include nuisance algae and periphyton growth. Indirect effects include low dissolved oxygen, increased methylmercury production, elevated pH, cyanotoxins from cyanobacteria (blue-green algae) production, trihalomethane production in drinking water systems, and maintenance issues associated with domestic water supplies.

Nuisance algae growth, including phytoplankton (water column algae), and periphyton (attached algae), and macrophytes (rooted plants) can adversely affect both aquatic life and recreational water uses. Algal blooms occur where nutrient concentrations (nitrogen and phosphorus) are sufficient to encourage excessive growth. The nutrient levels necessary for algae growth may occur at concentrations well below the identified water quality thresholds and criteria. Nutrient concentrations, flow rates, velocities, water temperatures, and sunlight penetration in the water column are all factors that influence algae, and macrophyte growth. When conditions are appropriate and nutrient concentrations exceed the quantities needed to support algal growth, excessive blooms may develop. These blooms can appear as layers or algal mats on the surface of the water.

Algal blooms often create objectionable odors in waters for recreation use and can produce intense coloration of both the water and shorelines. Water bodies demonstrating sufficient nutrient concentrations can cause excessive algal growth and are said to be eutrophic. However, algae is not always damaging to water quality. The extent of the effect is dependent on both the type(s) of algae present and the size, extent, and timing of the bloom. In many systems, algae provide a critical food source for many aquatic insects, which in turn serve as food for fish.

Algal growth also has indirect effects on water quality. When algae die, they sink through the water column and collecton the bottom sediments. As the algae decompose,the biochemical processes remove oxygen from the surrounding water. Because most of the decomposition occurs near the bottom of the water column, dissolved oxygen concentrations near the bottom of lakes and reservoirs can be depleted. Low DO in these areas can lead to decreased fish habitat and even fish kills if there are not other areas of water with sufficient DO available where the fish can take refuge.

4.4.1. Nutrient Differences between Monitoring Periods

Data collected in 2008 from the Bear River above and below Cutler Reservoir, Little Bear River, and Logan River indicate increases in total phosphorus concentrations since 2003 to levels similar to the 1996–1998 level (Figure 7). This pattern appears to follow the hydrologic pattern for the watershed with total phosphorus concentrations lowest during the drought period of 2000–2003.The low concentrations of orthophosphate in the Logan River and the Bear River are consistent across the sampling periods and indicate that the majority of phosphorus in the system is sediment-bound. Little Bear River appears to have reduced orthophosphate concentrations in 2008 compared to prior sampling periods. Extensive work to manage nutrients in the Little Bear River has been underway over the past 10 years. Phosphorus concentrations in Cutler Reservoir itself (Benson Marina) appear to follow a similar pattern with the highest orthophosphate concentrations occurring during the dry period of 2000–2003. Since phosphorus is relatively conservative in aquatic systems (there is no gaseous state), increased orthophosphate concentrations can be in part explained by lower flow levels that provide less dilution water for the phosphorus in the system. In addition, longer retention times and periods of water stagnation in the southern end of the reservoir could lead to more prevalent anoxic reducing environments which can lead to the release of dissolved phosphorus from precipitated ferric phosphates when the iron is reduced from Fe (III) to Fe (II) (Young and Ross 2001). Breakdown of organic phosphorus in reservoir sediments may also be responsible for the release of orthophosphate during low flow periods. Most of the phosphorus discharge to Spring Creek originates as an industrial discharge at the EA Miller packaging plant and does not necessarily follow hydrologic patterns. Construction of a treatment facility for EA Miller in 2010 wasintended to address this industrial discharge.

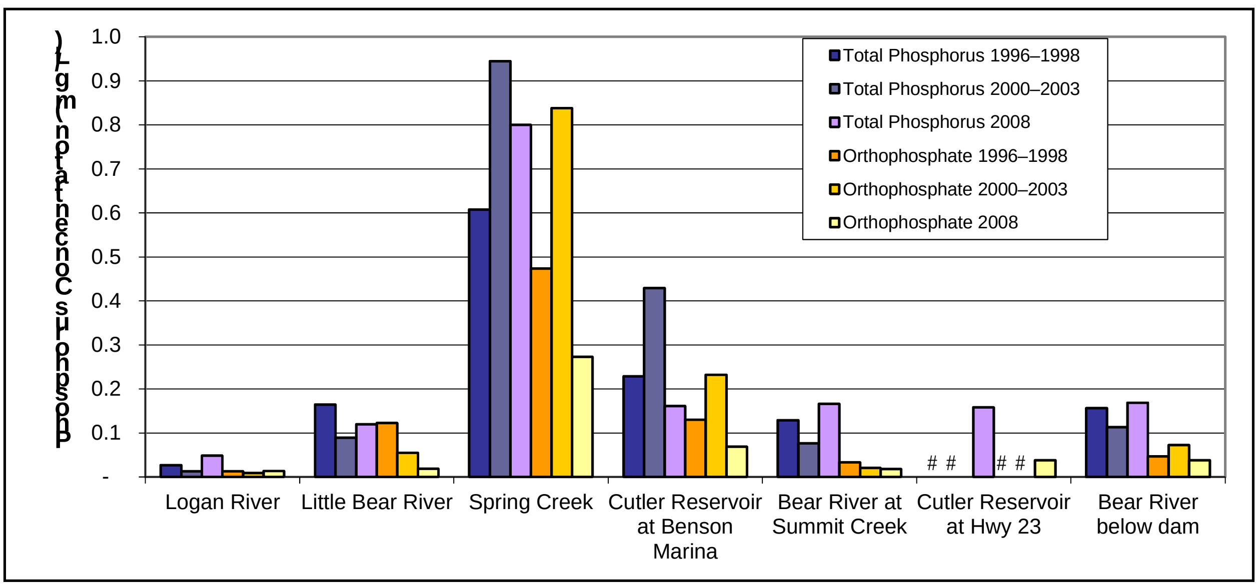


Figure 7. Phosphorus concentrations in Cutler Reservoirsystem during baseflowbetween first monitoring period (1996–1998) and third monitoring period (2008).

Both nitrate and ammonia concentrations have decreased or stayed the same in the Cutler Reservoir system since 2003,which could be a reflection of water quality projects conducted in the watershed and around the reservoir in the last decade (Figure 8). Notable decreases in nitrogen occurred as ammonia in Spring Creek and in Cutler Reservoir at Benson Marina. Nitrate levels have consistently decreased since 1996 in the Little Bear River and the Bear River above and below Cutler Reservoir. Generally, nitrate concentrations are higher than ammonia concentrations. The process of converting ammonia to nitrate is an aerobic process. Anoxic conditions are known to occur throughout Cutler Reservoir (UDWQ 2009). Anoxiais a prerequisite for denitrification (Schlesinger 1997), the conversion of nitrate to nitrogen gas (N_2), which could explain the lower concentrations of nitrate in the reservoir and Bear River compared to some of the tributary sites.

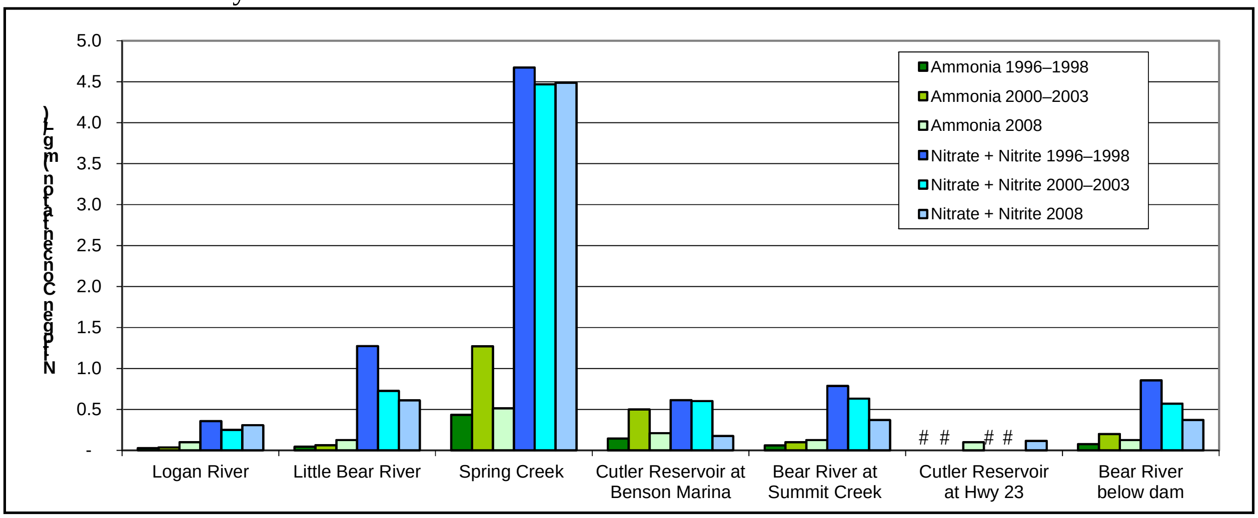


Figure 8. Change in nitrogen concentrations in Cutler Reservoir system during baseflow between first monitoring period (1996–1998) and third monitoring period (2008).

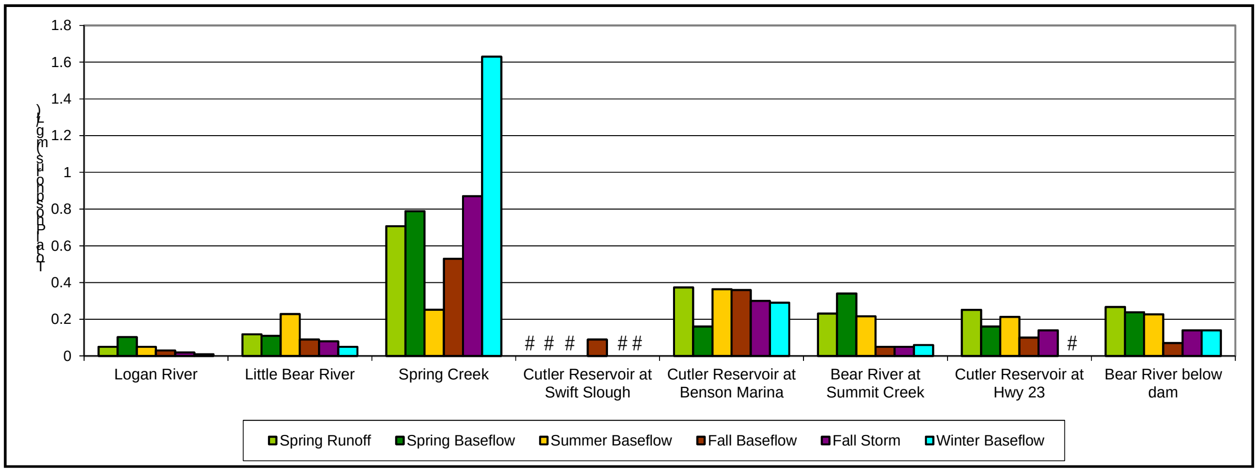
4.4.2. Seasonal and Hydroperiod Nutrient Variation

The Cutler Reservoir system, including its tributaries, represents relatively high nutrient conditions compared to other systems in Utah. With the exception of the samples collected in the Logan River, all of the total phosphorus samples collected in 2008 exceeded the total phosphorusthreshold value identified by the State of Utah for reservoirs (0.025 milligrams per liter [mg/L]) andstreams and rivers (0.05 mg/L). Nutrient concentrations in the Logan River, the highest-quality river in the study area, remain the lowest of the sites sampled. Phosphorus concentrations at Cutler Reservoir near Benson Marina are relatively consistent across seasons, with the lowest phosphorus levels recorded during the spring baseflow period, following spring runoff (Figures 9 and 10). Concentrations are also slightly lower in the fall and winter at this site. The high concentration of total phosphorus recorded in Spring Creek during the winter baseflow is consistent with other elevated results during the winter period. The highest total phosphorus concentration of 1.71 mg/L in Spring Creek was recorded on February 15, 2001. In the Little Bear River, the concentrations of total phosphorus and orthophosphate occur during the summer baseflow period with slightly lower values during the fall. In the Bear River and LoganRiver, the highest concentrations of phosphorus occur during the spring baseflow period. Neither the fall storm nor the spring runoff event resulted in significantly higher concentrations of total phosphorus, which is surprising considering the important role that washoff and hydrology typically play in nonpoint source nutrient loads (Novotny and Olem 1994). This could be the result of runoff from high mountain areas that are less disturbed and contain less sediment and phosphorus than runoff from the agricultural and urban landscapes in Cache Valley.

The only sample collected in Cutler Reservoir at Swift Slough was collected at a time when the City of Logan does not discharge effluent from the municipal wastewater treatment plant,which could explain the relatively low value of total phosphorus recorded at this site.

The majority of the nitrogen in the Cutler Reservoir system is inorganic with a higher proportion of the total nitrogen in inorganic form in the fall and winter seasons. Organic nitrogen concentrations appear to increase through the system, especially during the summer baseflow period. This could reflect biological activity and production within the Cutler Reservoir system.The highest concentrations of inorganic nitrogen are found in Spring Creek and are directly related to industrial discharge from EA Miller packaging plant to that tributary.

The Bear Riverand Cutler Reservoir both exhibited the highest concentrations of total inorganic nitrogen during winter baseflow, followed by spring runoff and the fall storm event.These results make sense in light of the fact that these tributaries drain primarily agricultural watersheds in which nitrate loads are tightly correlated with spring runoff and storm events. However, this pattern is not mirrored by organic nitrogen. Organic nitrogen concentrations in the system are generally highest during the spring and summer seasons. Organic nitrogen is converted to inorganic nitrogen during the summer and fall season through deposition of organic nitrogen in sediments and decomposition to ammonia (NH_3^-) in low oxygen conditions or nutrient-enriched waters (Lindell and Welch 1992). Nitrogen in the form of NH_3^- or NH_4^+, is taken up directly by plants or transformed to NO_2^- and NO_3^- through nitrification by anaerobic bacteria (Lindell and Welch 1992). Presumably, the process of nitrogen decomposition and denitrificationexplains the lower concentrations of organic nitrogen seen in the system during the summer and fall seasons.



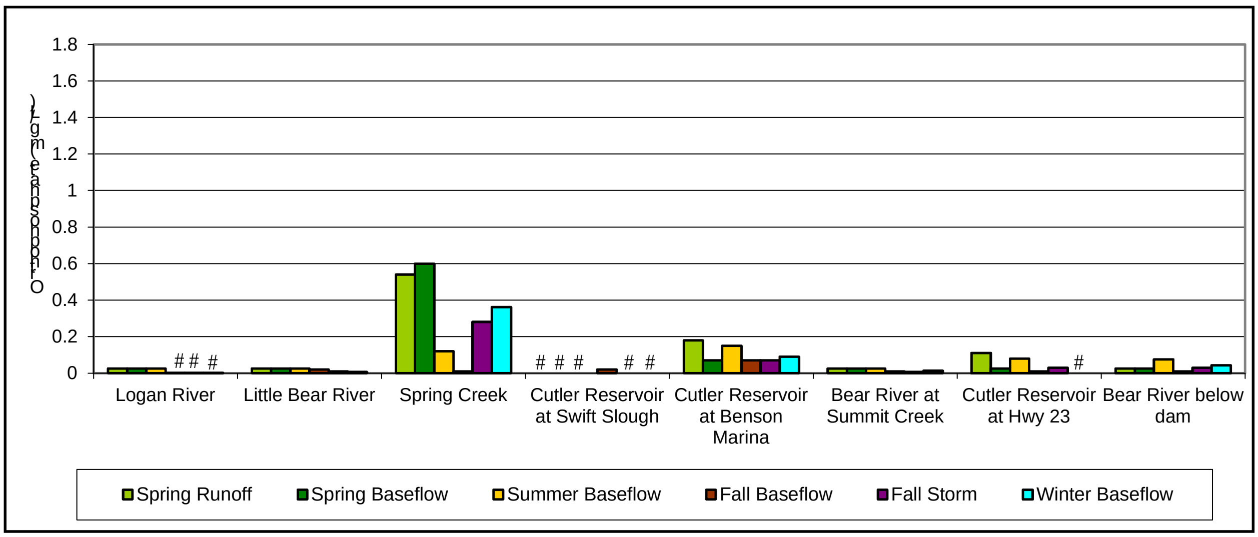


Figure 9. Phosphorus concentrations for sampling sites by 2008 hydroperiod.

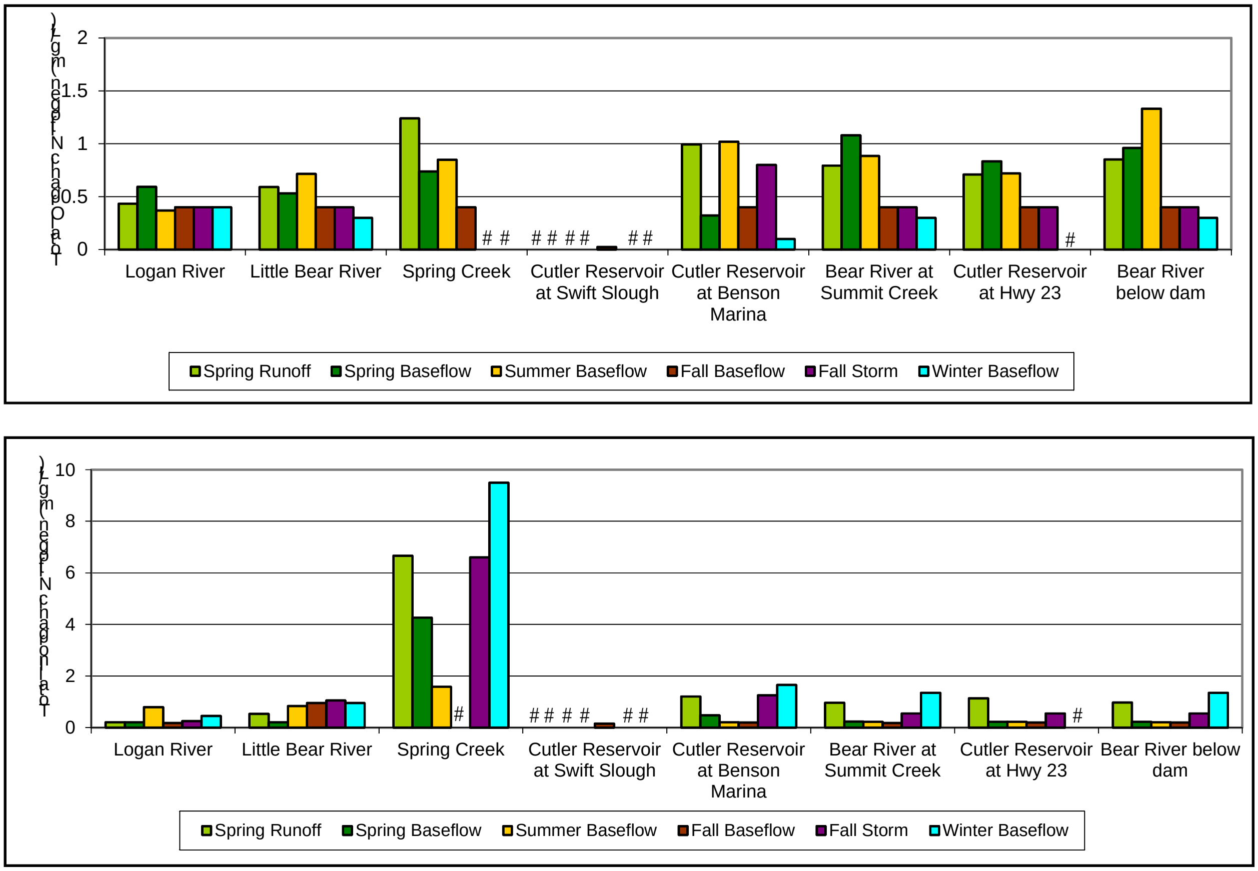


Figure 10. Total inorganic and organic nitrogen concentrations for sampling sites by 2008 hydroperiod.

4.5. Dissolved Oxygen

Dissolved oxygen is important to the health and viability of fish and other aquatic life. High concentrations of DO (6–8 mg/L or greater) are necessary for the health of aquatic life. Low concentrations of DO (below 4 mg/L) can result in stress to aquatic species, lowered resistance to environmental stressors, and even death at very low levels (less than 2 mg/L). Cutler Reservoir and itsassociated wetlands and tributaries contain a diverse fish community of largemouth bass, smallmouth bass, black crappie, green sunfish, bluegill sunfish, channel catfish, walleye, black bullhead, rainbow trout, brown trout, common carp, fathead minnow, and Utah sucker (Budy et al. 2006). Thresholds of DO for fish vary by species,as do a number of environmental conditions such as water temperature and hardness. Generally, fish are more tolerant to low oxygen levels at cold temperatures and low hardness.

Low DO often results from high nutrient, organic, or algal loading to a surface water system. Nutrients fuel algal growth, which in turn consumes oxygen from the water column during respiration (D'Avanzo and Kremer 1994). Organic sediment inputs and algae generated in a reservoir also result in reduced DO levels. When algae die and settle to the bottom of the water column or when organic matter enters a reservoir, aerobic decomposition depletes the oxygen supply in the overlying water.

Dissolved oxygen measurements were taken during all water quality sampling events except summer baseflow and the November storm event due to failure of the DO equipment. Dissolved oxygen values are generally very high throughout the Cutler Reservoir system at all sampling times (Table 7). The lowest values were recorded in Spring Creek and the Little Bear River during the 1996 to 1998 and 2000 to 2003 sampling events. However, even these minimum values are considered to be protective of fisheries. In 2008, the lowest DO value was recorded at the Cutler Reservoir site near Benson Marina during the winter baseflow sampling. It should be noted that all of the DO sampling occurred during the daylight hours when oxygen levels are expected to be elevated from photosynthetic activity. Conversely, DO levels drop during the nighttime when phytoplankton use available DO for respiration and no photosynthetic activity is occurring to replenish the oxygen supply. Thus, values of 6 mg/L during daylight hours could correlate to nighttime DO concentrations that are harmful to biota. A recent UDWQ assessment of stream benthic macroinvertebrates determined that the sections of the Little Bear River and Spring Creek near Cutler Reservoir are impaired based on biological criteria (UDWQ 2008). The impairment is related to the absence of 48% and 41% of the benthic macroinvertebrate species (for Little Bear River and Spring Creek, respectively) expected to occur at that site based on the streams natural, geomorphic, and watershed characteristics.

As expected, DO values fluctuated by hydroperiod throughout the Cutler Reservoir system. Seasonal values mirrored hydroperiod patterns, but did not account for the increase in DO that occurred across sampling sites during spring runoff events. This increase is most likely related to oxygenation associated with high flows and increased oxygen holding capacity associated with colder temperatures. No fall storm data were available for comparison to fall baseflow conditions.

Table 7. Dissolved Oxygen (mg/L) in the Cutler Reservoir System from 1996 to 2008

	Spring Baseflow	Spring Runoff	Summer Baseflow	Fall Baseflow	Fall Storm	Winter Baseflow	Annual Average	Annual Max	Annual Min	Annual Standard Deviation
1996–1998										
Logan River	9.6	–	8.2	9.5	–	10.5	9.5	10.5	8.2	0.8
Little Bear River	9.3	–	6.3	8.6	–	9.3	8.6	10.0	6.3	1.3
Spring Creek	8.8	–	5.8	8.4	–	10.5	8.4	10.5	5.8	1.6
Cutler Reservoir at Benson Marina	9.8	–	10.0	8.6	–	10.2	9.4	10.6	7.4	1.2
Bear River at Summit Creek	9.7	–	8.2	8.1	–	10.1	8.9	10.8	6.7	1.3
Bear River below dam	9.7	–	8.2	8.1	–	10.0	8.9	10.8	6.7	1.3
2000–2003										
LoganRiver	8.9	–	9.8	9.6	–	12.3	10.9	13.3	8.1	1.8
Little Bear River	7.7	–	6.5	8.2	–	11.9	9.8	13.4	6.0	2.8
Spring Creek	7.4	–	7.4	8.4	–	10.5	9.2	11.5	6.6	1.8
Cutler Reservoir at Benson Marina	8.3	–	6.8	11.7	–	11.1	10.4	14.9	6.8	2.7
Bear River at Summit Creek	7.0	–	7.1	8.5	–	11.7	9.8	13.0	7.0	2.4
Bear River below dam	7.0	–	7.1	8.5	–	11.7	9.8	13.0	7.0	2.4

Table 7. Dissolved Oxygen (mg/L) in the Cutler Reservoir System from 1996 to 2008

	Spring Baseflow	Spring Runoff	Summer Baseflow	Fall Baseflow	Fall Storm	Winter Baseflow	Annual Average	Annual Max	Annual Min	Annual Standard Deviation
2008										
LoganRiver	8.4	10.5	–	8.8	–	11.6	9.8	11.6	8.4	1.5
Little Bear River	7.6	9.7	–	8.3	–	11.2	9.2	11.2	7.6	1.6
Spring Creek	7.1	9.9	–	8.2	–	10.3	8.9	10.3	7.1	1.5
Cutler Reservoir south of Swift Slough	–	–	–	13.1	–	–	13.1	13.1	13.1	–
Cutler Reservoir at Benson Marina	8.7	9.8	–	10.8	–	5.5	8.7	10.8	5.5	2.3
Bear River at Summit Creek	7.5	9.4	–	8.1	–	11.0	8.8	11.0	7.5	1.4
Cutler Reservoir at Hwy 23	8.6	10.1	–	10.9	–	–	9.9	10.9	8.6	1.2
Bear River below dam	8.3	10.3	–	10.5	–	12.8	10.5	12.8	8.3	1.8

4.6. Turbidity and Sediment

Turbidity is a measurement of the visible clarity of water. Turbidity can be caused by both inorganic particles and suspended algae. Turbidity from inorganic particles can limit algal growth due to light limitation, even if there are sufficient nutrients for algal blooms. In Cutler Reservoir, large populations of carp contribute to turbid conditions by stirring up bottom sediments, which may confound efforts to measure sediment inputs into the system. Light limitation from large amounts of suspended inorganic particles can limit algal growth; however, turbidity is correlated with phytoplankton density in very productive aquatic systems (Wetzel 2001). Turbidity is often reported in nephelometric turbidity units (NTU), which represent the degree to which light is scattered in the water. Algal densities, measured as chlorophyll *a* concentration, can also be used to measure turbidity.

Sediment is the most visible pollutant in freshwaters, leading to increased turbidity in water. It is usually reflected in measurements of TSS measured in mg/L. Erosion of upland soils and stream banks are the primary causes of elevated sediment levels in rivers and reservoirs, both of which reflect land management practices in the watershed. Excessive sediment loading in receiving waters can lead to the alteration of aquatic habitat, reduced reservoir storage capacity due to sedimentation, and reduced aesthetic value of waters. Accumulation of sediments can directly harm fish and aquatic wildlife, or indirectly impact the functioning of aquatic systems by contributing to nutrient loading and eutrophication (algal overgrowth) (Novotny and Olem 1994).

4.6.1. Turbidity and Sediment Differences between Monitoring Periods

Turbidity and TSS sampling was conducted at the six monitoring sites during all monitoring periods. The data show that turbidity and TSS values are generally low for the watershed. A comparison of the data collected across all monitoring periods indicate that turbidity decreased at all sites during the 2000–2003 period and then increased to near or above 1996–1998 levels for the Bear River below Cutler Dam, the reservoir itself, and Spring Creek.There is no obvious explanation for the high turbidity values below

Cutler Dam. High values (over 100 NTUs) were recorded on May 20 and September 25 of 2008. Future monitoring will be needed to determine if this was an anomaly. Total suspended solids were also lower during the 2000–2003 period in the Bear River (above and below the reservoir), the Logan River, and in Cutler Reservoir itself. However, TSS increased at all sampling sites during2008 monitoring efforts except Benson Marina. These findings may be related to reduced runoff (erosion) in the basin during low water years, then increased runoff (erosion) with additional rainfall during 2008(Figure 11).

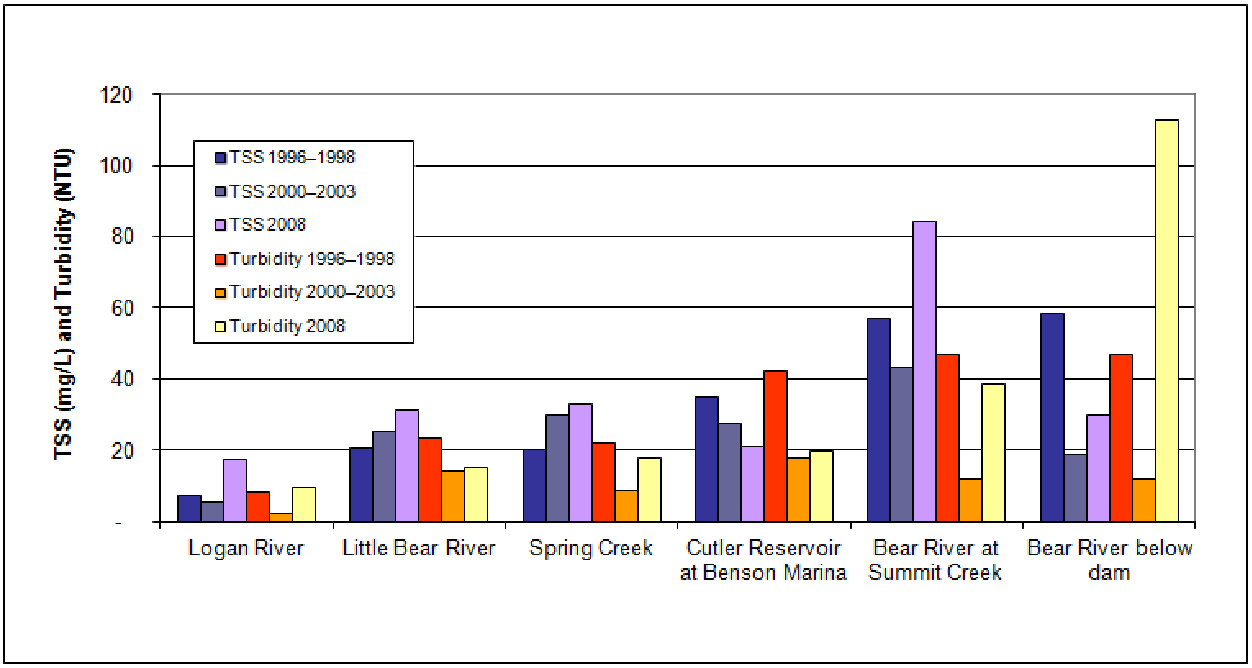


Figure 11. Average change in turbidity and TSS in the Cutler Reservoir system between first monitoring period (1996–1998) and the third monitoring period (2008).

Total suspended solids is commonly used as a proxy for sediment concerns in freshwaters.A TSS sediment target for many western states istypicallyset at less than or equal to 80 mg/L for acute events lasting no more than 14 days, and less than or equal to 50 mg/L as a monthly average. The Idaho Department of Environmental Quality (IDEQ) has used the the seasonal target of 50 mg/L and 80 mg/L for TSS in several subbasins, including the Boise River (IDEQ 1999) and Portneuf River (IDEQ 2001). This provides some context for the TSS values recorded in the Cutler Reservoir system.

4.6.2. Seasonal and Hydroperiod Variation of Turbidity and Sediment

Sediment concentrations and turbidity exhibit different patterns across hydroperiodsfor many different sites (Figures 12 and13). The Bear River above and below the reservoir and the reservoir itself exhibited significantly higher levels of turbidity and sediment during spring and summer baseflow. This is likely related to erosion during the irrigation season and spring runoff events, which were also significant contributorsto TSS above and beyond spring baseflow conditions. Although fall baseflow conditions only yielded moderate sediment and turbidity loads, fall storms did also provide an important source of TSS and turbidity for the reservoir and Bear River.

Total suspended solids and turbidity concentrations are only strongly associated at some sites and seasons (see Figures 12 and 13) such as Little Bear River and the Bear River. This suggests that turbidity spikes could be related to growth of suspended algae rather than increased sediment loads. Unfortunately, no spring runoff or fall storm turbidity data were collected between 1996 and 2008 for comparison purposes.Additional data are needed to determine if the high turbidity recordings in the Bear River below Cutler Dam are representative of conditions during spring and fall baseflow. Collection of chlorophyll *a* data would improve our understanding of the causes of this turbidity.

As with other assessed parameters, seasonal trends mirror hydroperiod patterns, but failed to account for the relative influence of spring runoff and stormson TSS and turbidity levels.

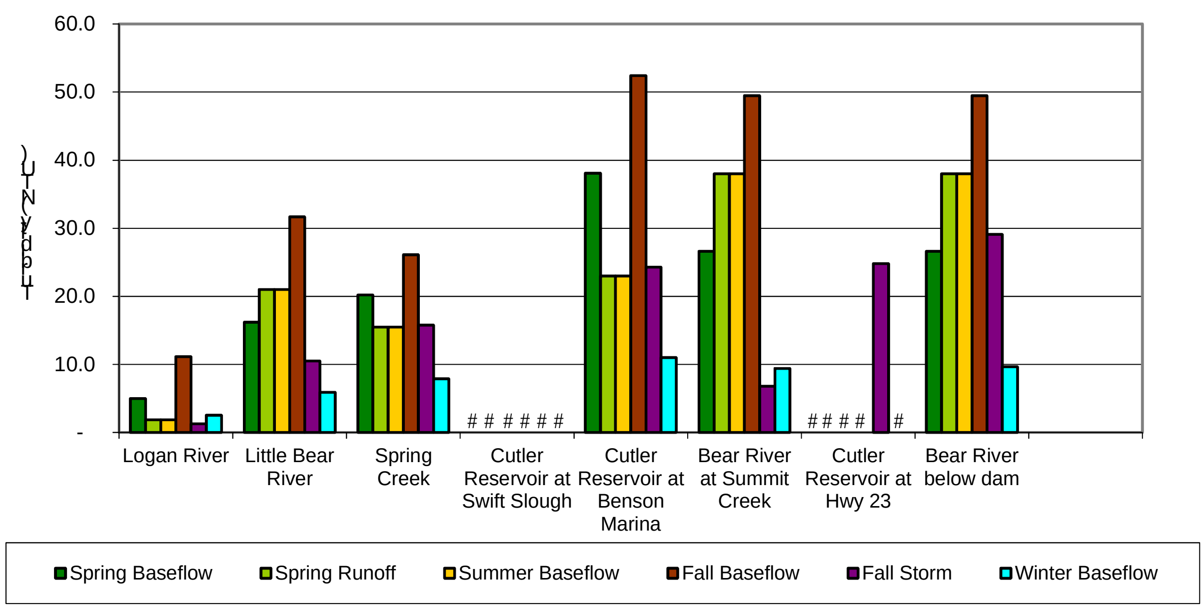


Figure 12. Average turbidity (NTUs) for sampling sites by 2008 hydroperiod.

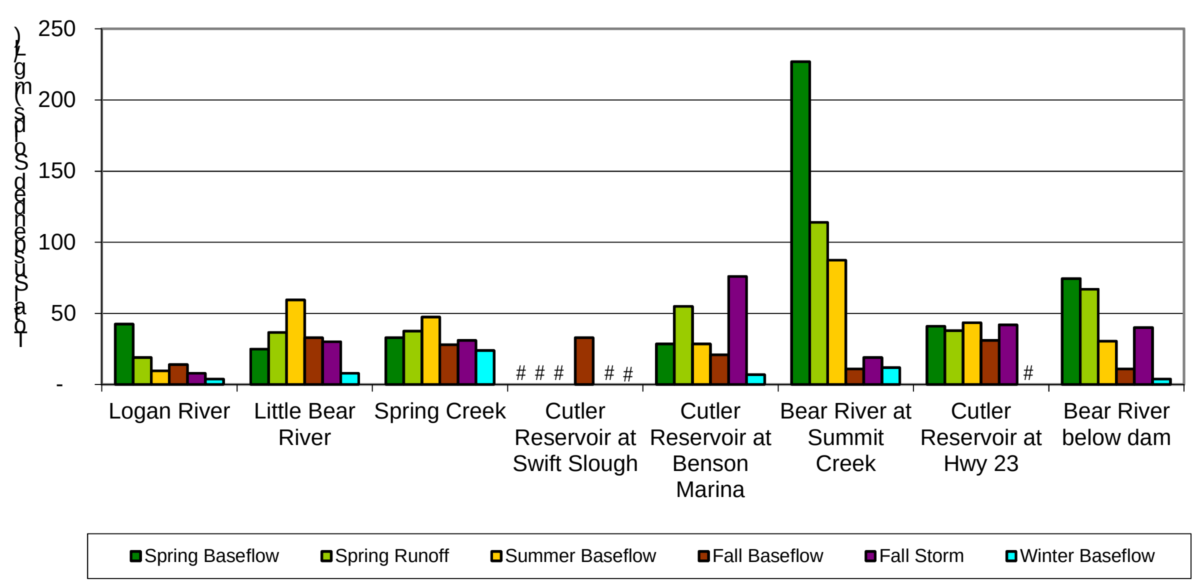


Figure 13. Average sediment concentration (TSS) for sampling sites by 2008 hydroperiod.

4.7. Trophic State Index

Water bodies with high nutrient concentrations (that could lead to a high level of algal growth) are said to be eutrophic. The health and support status of a water body can be assessed using a Trophic State Index (TSI). This index is a measurement of the biological productivity or growth potential of a body of water. The basis for TSI classification is algal biomass (an estimation of how much algae is present in the water body). The calculation of a TSI generally includes the relationship between chlorophyll (the green pigment in algae), transparency using Secchi depth measurements, total phosphorus, and total nitrogen (Carlson and Simpson 1996).

Since no Secchi depth, chlorophyll *a* data, or organic nitrogen is available in this dataset, the TSI analysis presented here is limited to trophic state predictions related to total phosphorus, and is calculated using the following equation:

$$TSI\ TP = 14.42\ Ln\ (TP) + 4.15$$

Table 8 identifies generally accepted TSI values derived from this relationship. In most cases, the greater the TSI value a water body has (based on collected data), the more eutrophic the water body is considered to be.

Table 8. TSI Values and Status Indicators

TSI	Trophic Status and Water Quality Indicators
<30	Highly oligotrophic, clear water, and high DO throughout the year in the entire hypolimnion
30–40	Oligotrophic, clear water, and possible periods of limited hypolimnetic anoxia (DO=0)
40–50	Mesotrophic, moderately clear water, increased chance of hypolimnetic anoxia in summer,cold-water fisheries threatened, and supportive of warm-water fisheries
50–60	Mildly eutrophic, decreased transparency, anoxic hypolimnion,macrophyte problems, and generally supportive of warm-water fisheries only
60–70	Eutrophic, blue-green algae dominance, scums possible, and extensive macrophyte problems
70–80	Hypereutrophic, heavy algal blooms possible throughout summer, and dense macrophyte beds
>80	Algal scums, summer fish kills, few macrophytes due to algal shading, and"rough fish" dominance

Source: Carlson and Simpson 1996.

The trophic scale illustrates these general classifications, as well as the midrange conditions that occur between each major category. However, each water body is unique and will exhibit site-specific characteristics based on the water quality conditions identified within the lake or reservoir and over specific time periods, seasons, or water-flow conditions. The identification of TSI values for a specific water body allows a general classification and provides insight into overall water quality trends and seasonality.

The TSI values calculated indicate that Cutler Reservoir routinely experiences eutrophic to hypereutrophic conditions (Figure 14). Nowhere in the reservoir or its inflowing tributaries were the TSI values indicative of non-eutrophic conditions. There has been no change in the general trend in trophic state since sampling began in 1996.

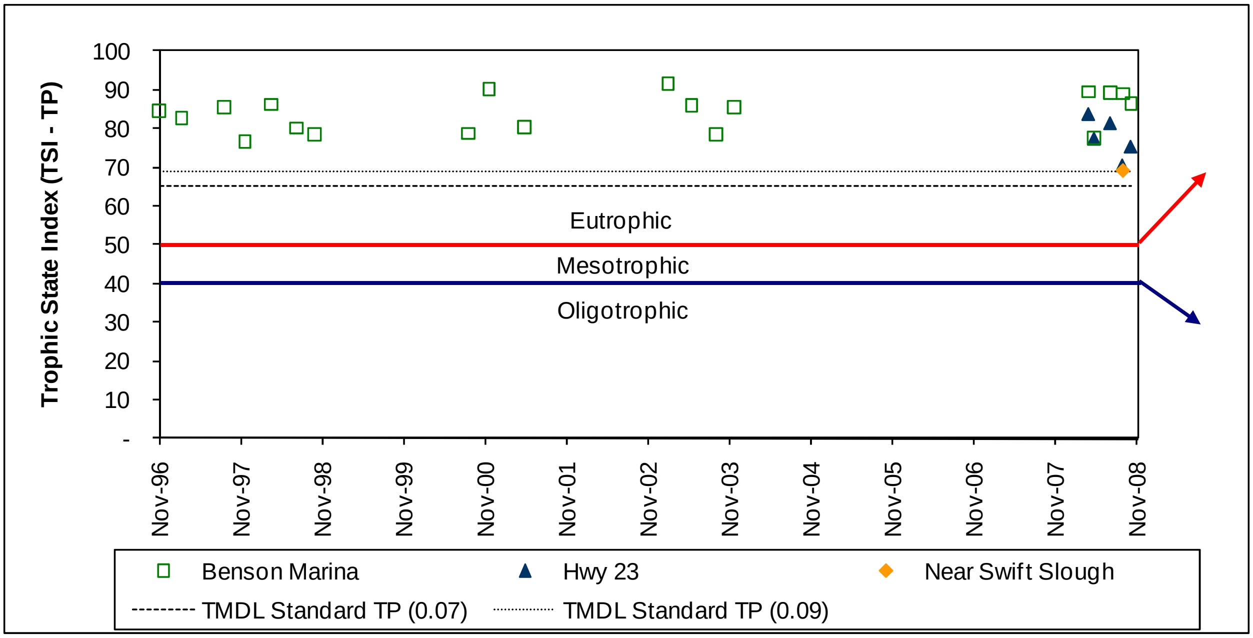


Figure 14. Trophic state index (TSI) predicted based on total phosphorus concentrations in Cutler Reservoir.

5. SPATIAL SUMMARY OF DATA

Consistent with previous water quality results, data collected in 2008 indicate that water quality in the southern tributaries, specifically Spring Creek and the Little Bear River, have significant impacts on water quality throughout Cutler Reservoir.Spring Creek continues to have elevated nutrient and coliform bacteriaconcentrations as compared to the other sampling locations within the watershed. The Bear River exhibits the highest concentrations of sediment in the watershed.

Nutrient concentrations in the southern section of the reservoir remain markedly higher than the northern section (Figures 15 and 16). This is in part due to the shallow nature of the southern reservoir and the limited flow-through that occurs. TSS values throughout the reservoir are lower than tributary TSS (Figure 17). This is a common pattern in reservoirs because as tributaries enter a reservoir the flow rate is reduced and sediment falls out (Figure 18(. The Bear River and Little Bear River have higher concentrations of coliforms than other tributaries and the southern reservoir has more coliform than the northern section.

Based on the load analysis conducted for the Cutler Reservoir TMDL, the highest total phosphorus loads to the southern reservoir come from Spring Creek (approximately 23%) andthe Logan City Regional Wastewater Treatment Plant that discharges to Swift Slough (approximately 28%). In addition, runoff from fields near Cutler Reservoir that are irrigated with LoganCity wastewater may account for an additional 17% of the load to the southern reservoir during the growing season. The Spring Creek TMDL is currently being implemented and is expected to result in substantial load reductions from the JBS Swift and Company discharge, which will translate into significant load reductions from Spring Creek. Load reductions for the Logan City Regional Wastewater Treatment Plant are identified in the Cutler Reservoir TMDL currently under development. The limited flow-through is caused by the numerous constriction points and prevalent stands of emergent vegetation that occur throughout the southern section of the reservoir. Due to this slow moving water and the shallow nature of the southern reservoir (1.8 feet mean depth), reservoir sediments likely exert a greater influence on water quality than in the faster-flowing and deeper northern reservoir (3.6 feet mean depth).

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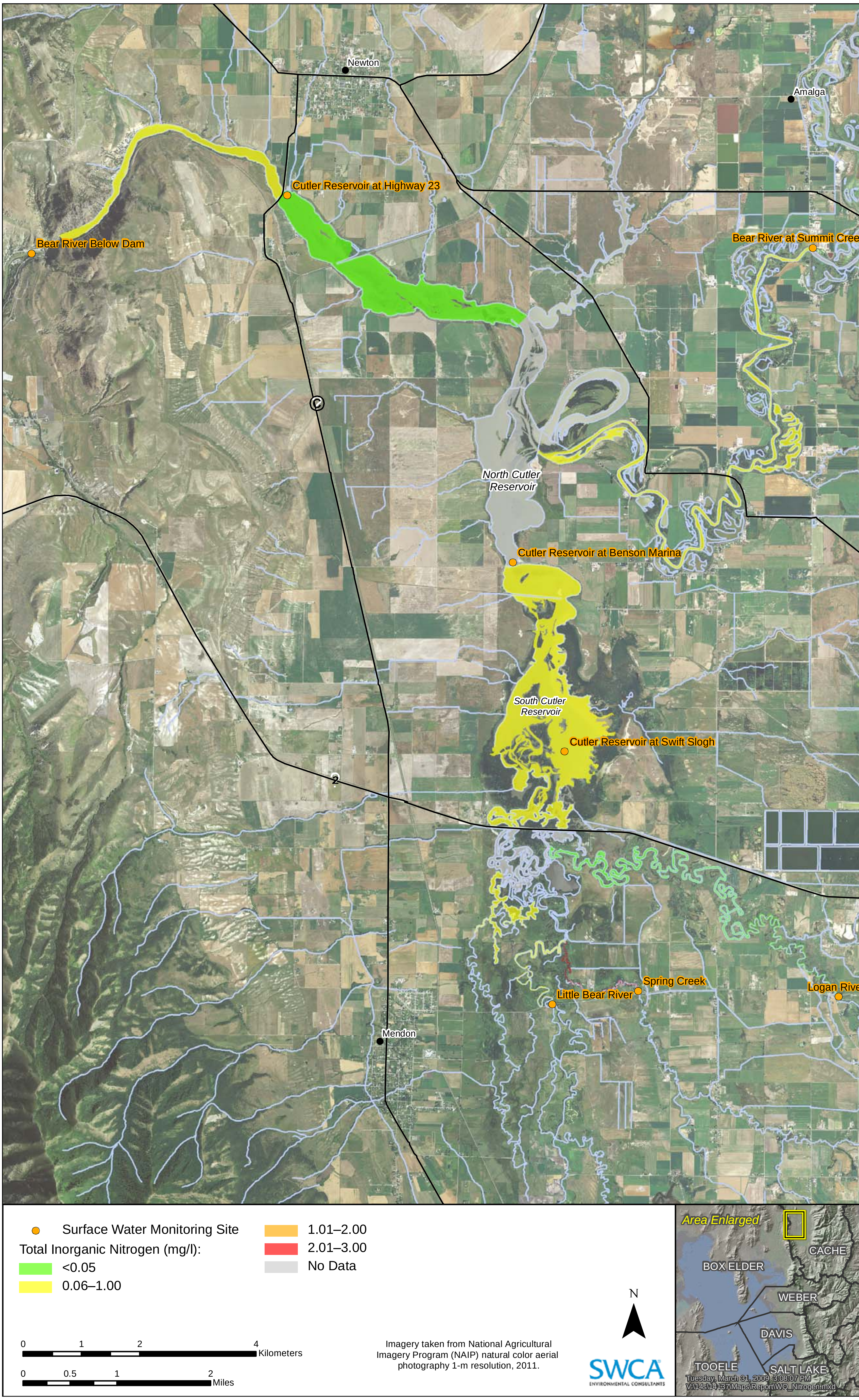

Figure 15. Total inorganic nitrogen levels in the Cutler Reservoir system during baseflow sampling (average of all baseflow 2008 samples) in 2008.

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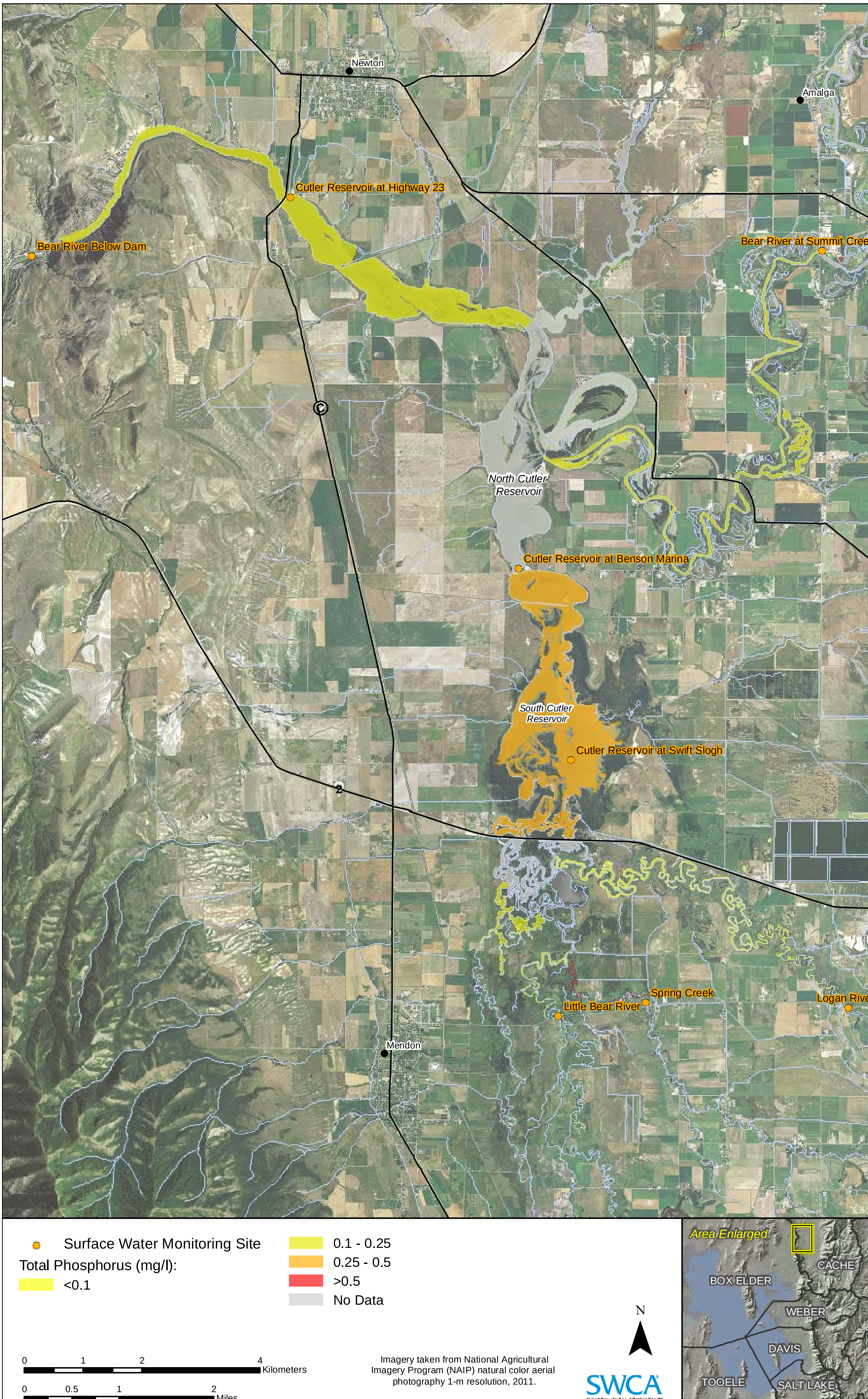

Figure 16. Total phosphorus concentrations in the Cutler Reservoir system during baseflow sampling in 2008.

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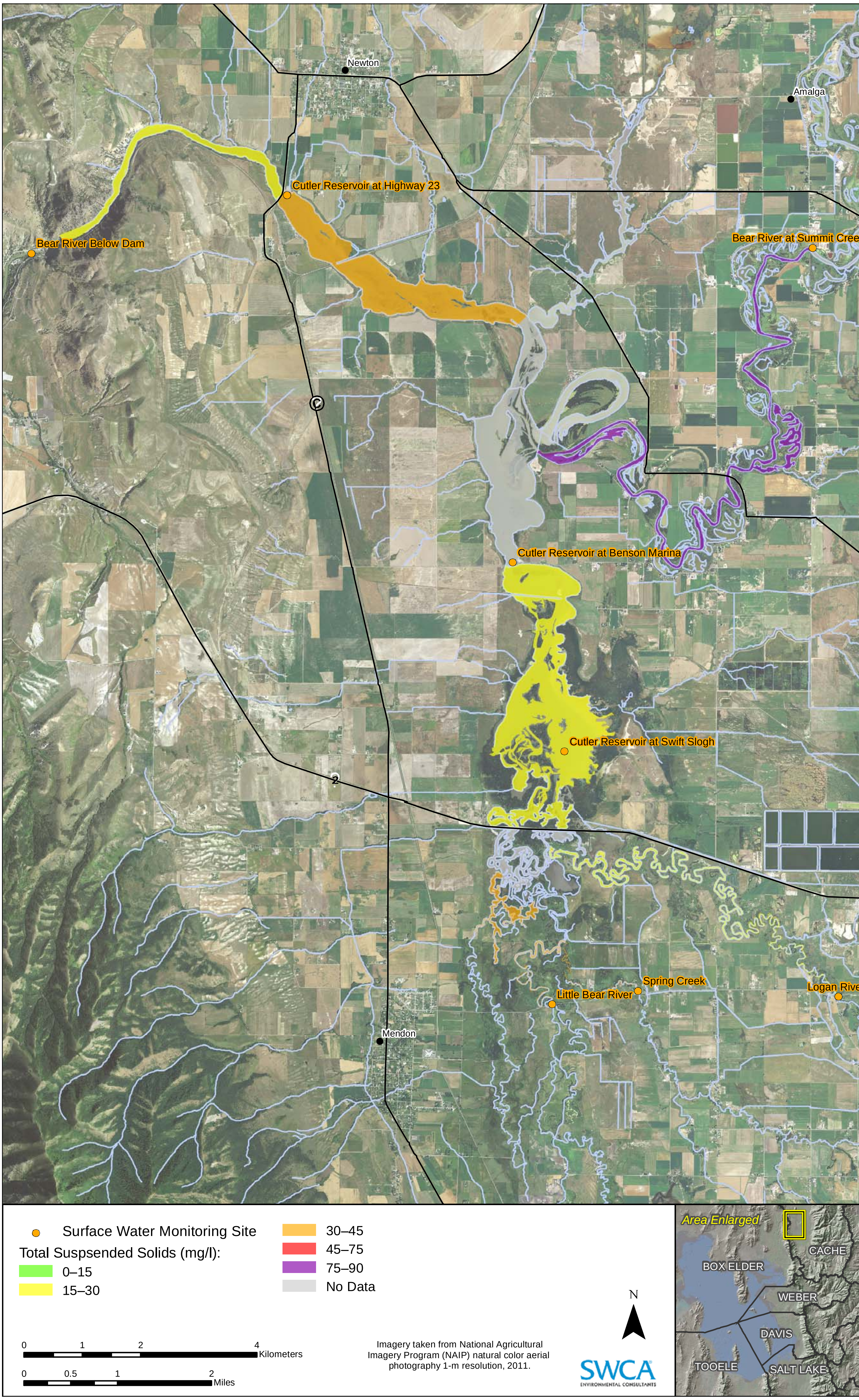

Figure 17. Total suspended solids concentrations in the Cutler Reservoir system during baseflow sampling in 2008.

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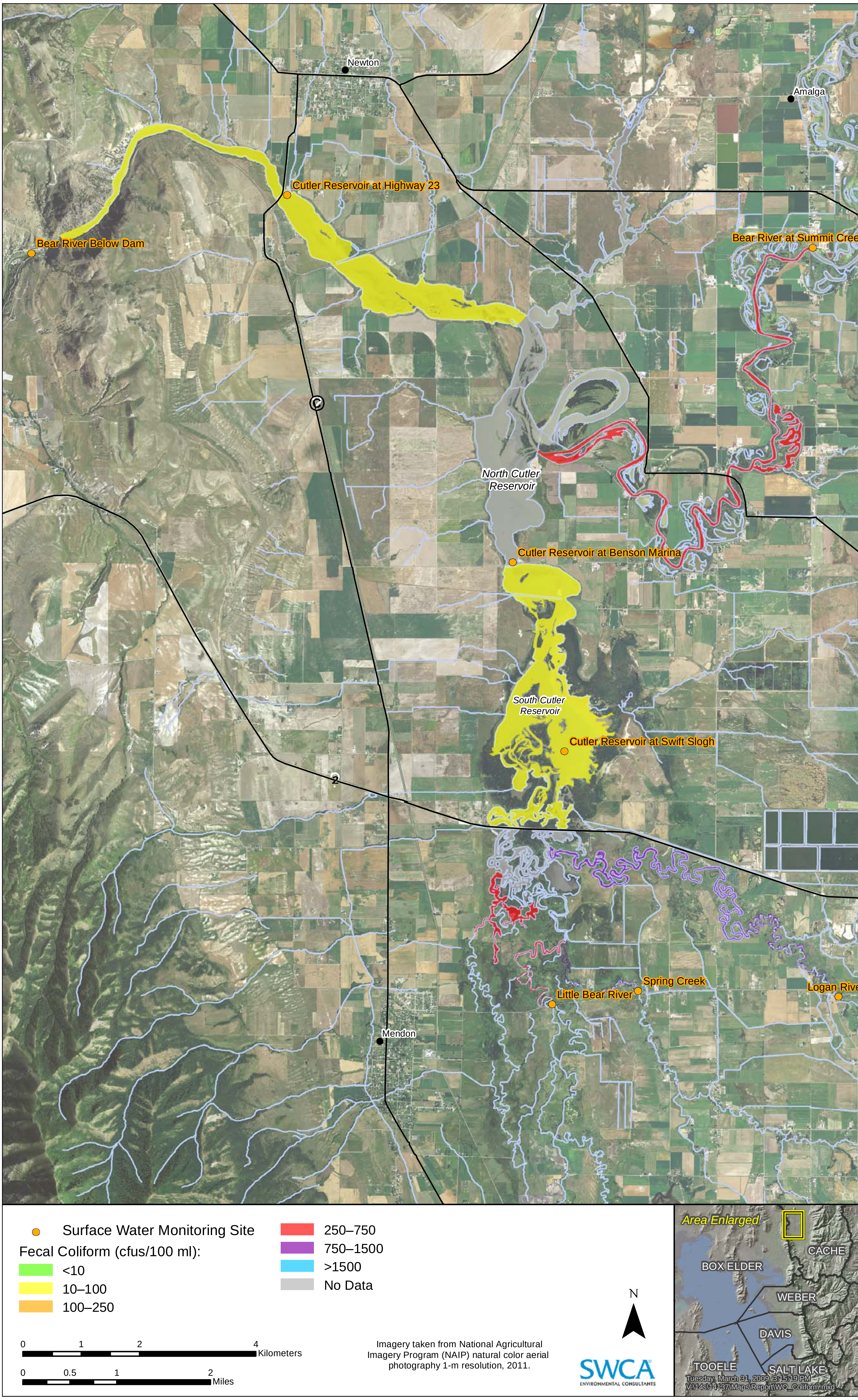

Figure 18. Fecal coliform concentrations in the Cutler Reservoir system during baseflow sampling in 2008.

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6. CUTLER RESERVOIR RESTORATION PROJECTS

PacifiCorp has numerous mitigation projects planned and constructed within the watershed, as outlined in the Cutler Hydro Project 5-yearimplementation plan (PacifiCorp 2002, 2008). Included within the implemented Cutler RMP (PacifiCorp 2002)are shoreline buffers, bank stabilization, woodland plantings, fencing for livestock restrictions, grazing management practices, and fish habitat enhancement. Initial monitoring results for the Cutler RMP implementation efforts have rated most of the mitigation/restoration work as good to excellent condition on the majority of the implementation sites. Limited sites were rated as poor, destroyed, or had failed to establish per the standards detailed in the CutlerRMP. The majority of work around Cutler Reservoir has taken place along the southern tributaries and the reservoir unit, therefore affecting water quality in the Little Bear River, Spring Creek, the Logan River, and the main section of Cutler Reservoir.

7. RECOMMENDATIONS

To improve comparability across sampling periods, future monitoring should occur at the same sampling locations and following the same seasonal distribution as the samples collected in 2008.In addition, samples should be analyzed using the same methods as those used in 2008. This will help to clarify whether some surprising findings are persistent, such as high pH in Cutler Reservoir and high turbidity in the Bear River below Cutler Dam

In addition, there are several additional parameters recommended for future monitoring. *E. coli*, in addition to total and fecal coliform, should be collected in the future to assess compliance with new state water quality standards that recently shifted to *E. coli*from fecal coliform. Chlorophyll *a* data would help to identify potential causes of high turbidity during low flow periods. Where possible, chlorophyll *a* – dissolved oxygen – and nutrient data collected together would be useful in quantifying the linkage between nutrient and low DO as a result of algal respiration.

8. LITERATURE CITED

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Appendix A. Water Quality Sampling data results for 2008 sampling period.

Station Name	Activity Start	Dissolved oxygen (DO)	Fecal Coliform	Nitrogen, ammonia as N	Nitrogen, Nitrate (NO3) as NO3	pH	pH	Phosphorus as P	Phosphorus, Orthophosphate as P	Solids, Total Suspended (TSS)	Specific conductance	TDS	Temperature, water	Total Coliform	Total Inorganic Nitrogen	Total Organic Nitrogen	Turbidity
BEAR R BL CNFL / SUMMIT CK	4/24/2008	9.4	30	0.10	0.83	8.8		0.23	0.03	114	895		8.46	201	0.93	0.79	
	4/25/2008											446					48.5
	5/20/2008	7.5	822	0.10	0.10	8.8		0.34	0.03	227	447	260	15.46		0.71	1.08	101.8
	8/1/2008		81	0.10	0.10	9.1		0.22	0.03	88	843	466	23.3	3,630	0.60	0.89	38.3
	9/25/2008	8.1		0.10	0.03	8.8		0.05	0.01	11	957	540	14.55		0.34	0.40	5.6
	10/2/2008		68											1,100			
	11/2/2008		35	0.10	0.40	8.3		0.05	0.01	19	958	592	10.55	3,630	0.53	0.40	6.8
	1/15/2009	11.0	49	0.20	1.10		8.35	0.06	0.01	12	1	564	0	300	0.93	0.30	8.7
BEAR R BL CUTLER RES AT	4/24/2008	10.3	62	0.10	0.84	8.8		0.27	0.03	67	844		10.04	201	0.96	0.85	
	4/25/2008											422					43.2
	5/20/2008	8.3	68	0.10	0.10	8.5		0.24	0.03	75	24	288	18.35		0.64	0.96	145.9
	8/1/2008		39	0.10	0.10	8.5		0.23	0.08	31	64	722	27.04	3,630	0.82	1.33	2.2
	9/25/2008	10.5		0.10	0.05	9.0		0.07	0.01	11	1	726	17.46		0.35	0.40	190.5
	10/2/2008		21											690			
	11/2/2008		5	0.10	0.40	8.5		0.14	0.03	40	729	506	10.58	980	0.53	0.40	29.1
	1/15/2009	12.8	1	0.20	1.10		8.35	0.14	0.04	4		434	0	66	0.93	0.30	
CUTLER RES BENSON MARINA	4/24/2008	9.8	266	0.34	0.84	8.9		0.37	0.18	55	570		9.36	816	1.27	0.99	
	4/25/2008											288					33.9
	5/20/2008	8.7	78	0.24	0.22	8.8		0.16	0.07	29	376	230	19.95		0.52	0.32	23.0
	8/1/2008		15	0.10	0.10	9.2		0.36	0.15	29	565	328	24.94	3,630	0.67	1.02	28.2
	9/25/2008	10.8		0.10	0.05	8.5		0.36	0.07	21	648	362	15.2		0.35	0.40	19.3
	10/2/2008		35											250			
	11/2/2008		68	0.20	1.00	8.4		0.30	0.07	76	507	388	11.03	2,000	1.13	0.80	24.3
	1/15/2009	5.5	6	0.40	1.20		8.15	0.29	0.09	7	581	302	0.94	170	1.08	0.10	8.5
CUTLER RES E OF HIGHWAY BRIDGE	4/24/2008	10.1	134	0.10	1.00	8.9		0.25	0.11	38	785		9.32	980	0.97	0.71	
	4/25/2008											400					36.8
	5/20/2008	8.6	54	0.10	0.10	9.0		0.16	0.03	41	437	260	19		0.58	0.83	35.0
	8/1/2008		17	0.10	0.10	9.0		0.21	0.08	44	716	402	24.91	3,630	0.52	0.72	31.0
	9/25/2008	10.9		0.10	0.05	9.1		0.10	0.01	31	846	484	16.04		0.35	0.40	11.8
	10/2/2008		130											410			
	11/2/2008		16	0.10	0.40	8.5		0.14	0.03	42	739	504	10.9	1,700	0.53	0.40	24.8
CUTLER RES S OF SWIFT SLOUGH	9/25/2008	13.1		0.10	0.05	8.9		0.09	0.02	33	548	318	14.14		0.33	0.03	18.0
	10/2/2008		16											410			
LITTLE BEAR R @ CR376 XING	4/24/2008	9.7	105	0.10	0.42	8.8		0.12	0.03	37	534		6.94	168	0.61	0.59	
	4/25/2008											274					14.8
	5/20/2008	7.6	1,156	0.10	0.10	8.5		0.11	0.03	25	672	220	17.4		0.42	0.53	10.4
	8/1/2008		975	0.10	0.71	8.8		0.23	0.03	60	614	354	19.67	3,630	0.82	0.72	28.7
	9/25/2008	8.3		0.10	0.05	8.4		0.09	0.02	33	640	374	11.37		0.73	0.40	16.3
	10/2/2008		334											1,300			
	11/2/2008		318	0.10	0.90	7.9		0.08	0.01	30	600	410	10.72	3,600	0.78	0.40	10.5
	1/15/2009	11.2	54	0.20	0.70		8.09	0.05	0.01	8	0	308	1.25	300	0.73	0.30	5.0
LOGAN R AB CNFL / LITTLE BEAR R	4/24/2008	10.5	172	0.10	0.10	8.7		0.05	0.03	19	451		6.99	548	0.37	0.43	
	4/25/2008											202					8.1
	5/20/2008	8.4	2,067	0.10	0.10	8.7		0.10	0.03	43	292	156	9.85		0.45	0.59	30.8
	8/1/2008		1,298	0.10	0.68			0.05	0.03	10	489	270	17.3	3,630	0.63	0.37	2.6
	9/25/2008	8.8		0.10	0.05	8.5		0.03	0.00	14	492	278	10.87		0.34	0.40	3.3
	10/2/2008		525											980			
	11/2/2008		157	0.10	0.10	8.0		0.02	0.00	8	410	310	9.73	3,600	0.38	0.40	1.3
	1/15/2009	11.6	46	0.10	0.30		8.89	0.01	0.00	4	447	232	2.46	300	0.48	0.40	2.5
SPRING CK @ CR 376 (MENDON)	4/24/2008	9.9	580	0.10	6.49	8.7		0.71	0.54	38	872		8.5	866	4.00	1.24	
	4/25/2008											456					199.8
	5/20/2008	7.1	1,000	0.25	3.90	8.5		0.79	0.60	33	672	388	17.4		2.63	0.74	15.7
	8/1/2008		3,630	0.10	1.45	8.7		0.25	0.12	48	560	310	20.07	3,630	1.26	0.85	25.2
	9/25/2008	8.2		0.10	0.05	8.4		0.53	0.01	28	659	388	12.05		0.50	0.40	14.4
	10/2/2008		350											820			
	11/2/2008		239	0.50	5.90	7.8		0.87	0.28	31	712	470	11.09	3,600	3.55	-	15.8
	1/15/2009	10.3	132	1.60	7.80		8.06	1.63	0.36	24	1	510	3.15	300	5.00	-	17.2

APPENDIX H

CUTLER RESERVOIR WATER LEVEL ANNUAL SUMMARIES

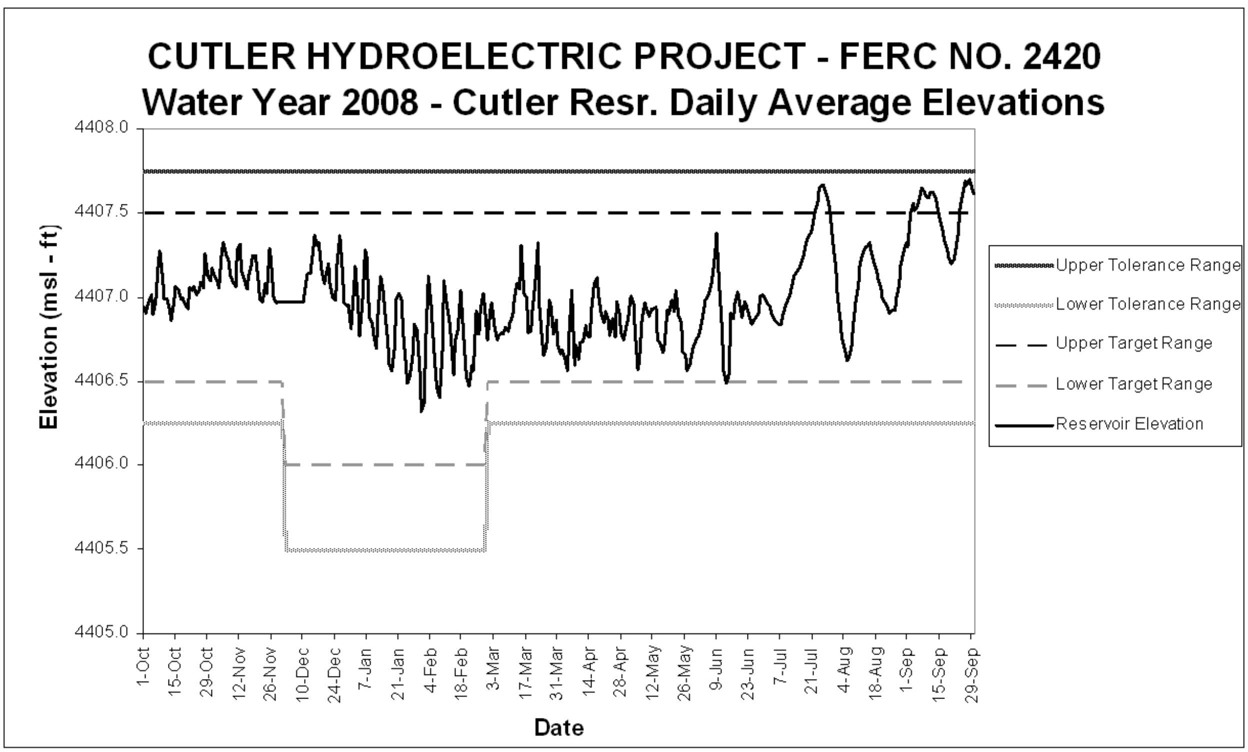
APPENDIX H
RESERVOIR WATER LEVELS

The graphs below show the daily average adjusted elevation of Cutler Reservoir at the dam. A few general features that are present in certain years are described below.

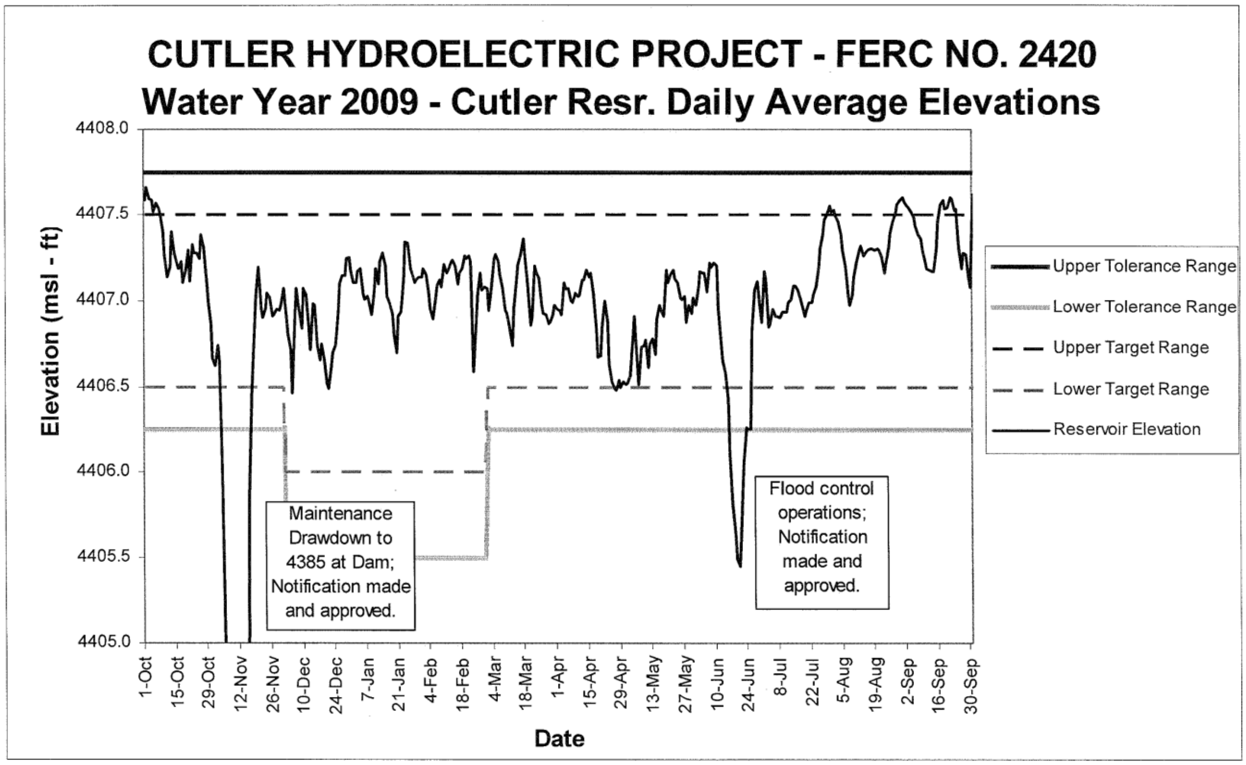
Every year, fluctuations during the summer are due to changes in irrigation demand and the resulting adjustments made at the Bear Lake Outlet Canal, which has a four-day water travel time to reach Cutler Reservoir. The Bear Lake Outlet Canal provides a very large fraction of the irrigation demand in the summer. Rainfall runoff events also result in fluctuations due to the water travel time from the Bear Lake Outlet Canal since reductions cannot be made fast enough to avoid excess inflow into Cutler Reservoir.

In dry years, the elevation is kept near the upper target at the beginning of irrigation season (May to June) to buffer increasing irrigation demands.

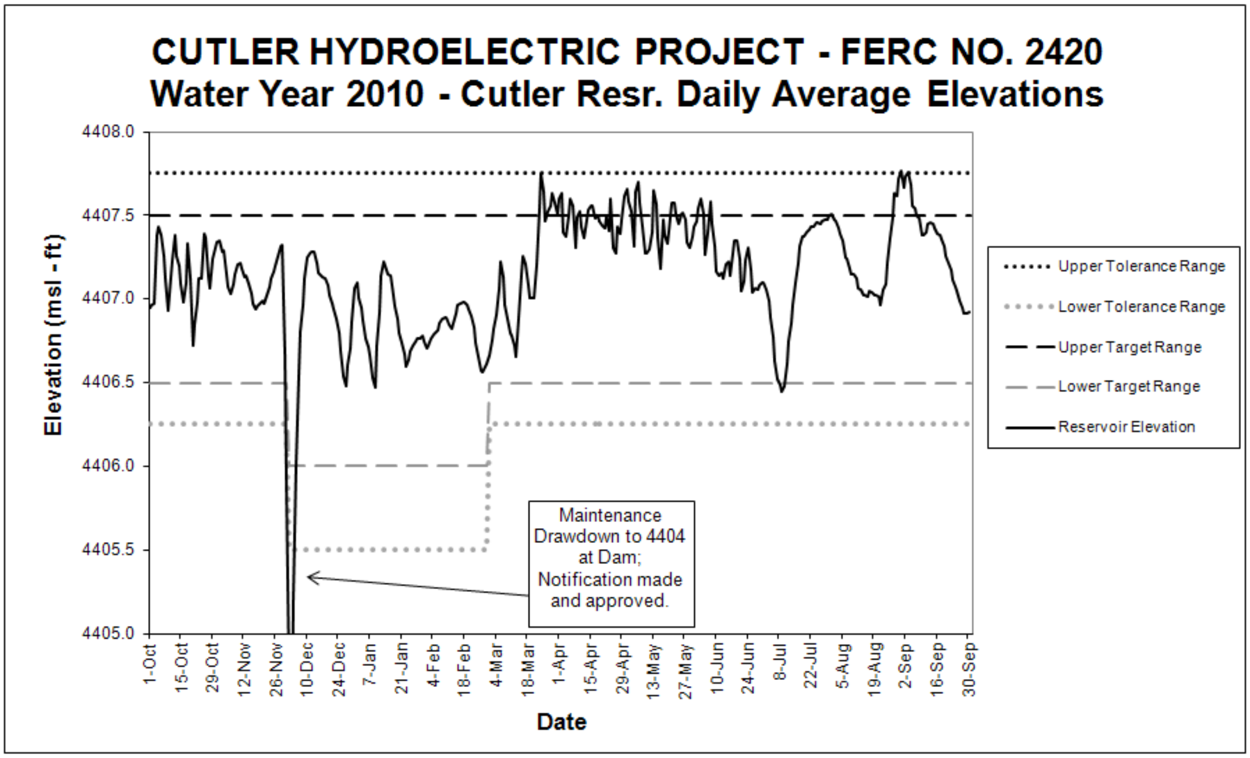
In wet years, the elevation is kept low during snowmelt runoff (April to June) to reduce downstream peak flows during the vigorous snowmelt runoff period.



Fluctuations during the summer of water year 2008 resulted from changes in irrigation demand and the adjustments made at the Bear Lake Outlet Canal which has a four-day water travel time to reach Cutler Reservoir.

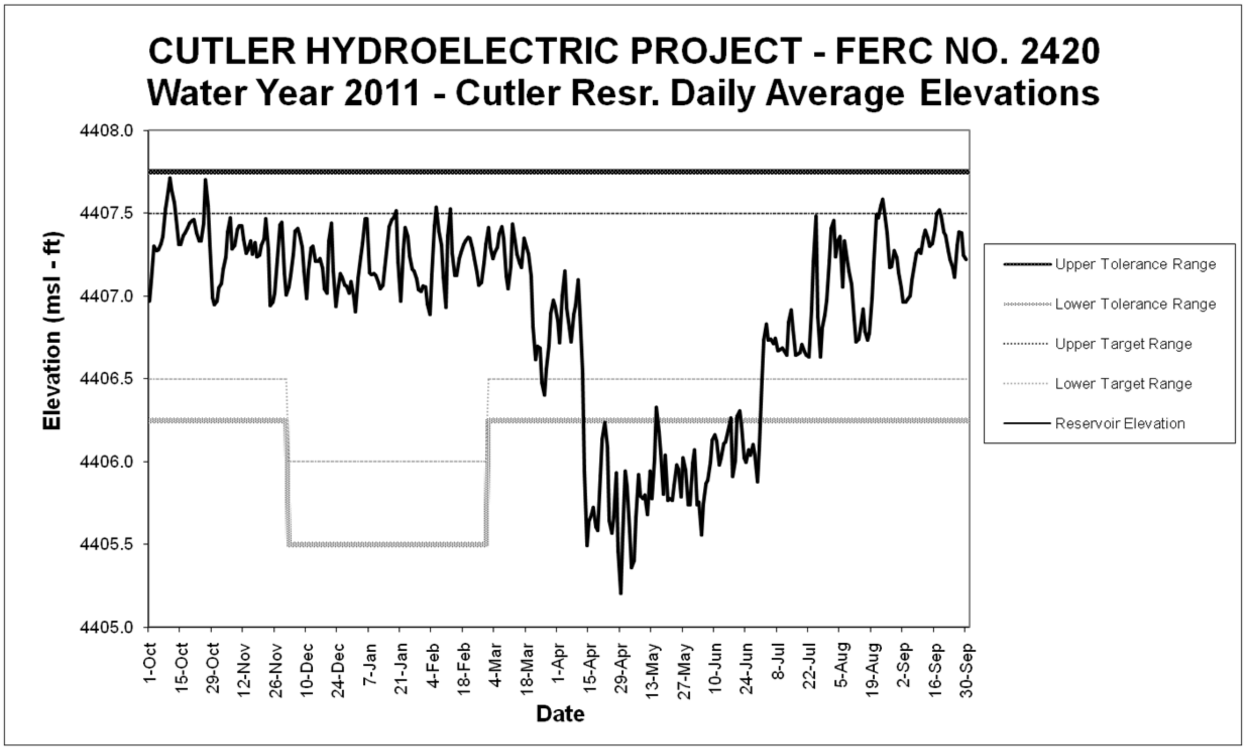


A fall maintenance drawdown resulted in the elevation being below the lower tolerance from Nov 4-16, 2008 (inclusive). At the dam the water level fell to an estimated 4,385 feet, while at Benson Marina the lowest level recorded was 4404.32 feet (not shown on the graph above). The reservoir elevation gage at Benson Marina is 6 miles upstream from the elevation gage at the dam. The difference in elevation is due to the unique character of the reservoir which is an inundated a river channel that reverts to a river configuration when the water level at the dam is drawn down extremely low. The water level decrease in the upper portion of the reservoir is limited by the former river bed.
Also, in the spring a short period of flood control operation was necessary in anticipation of possibly vigorous spring snowmelt runoff.

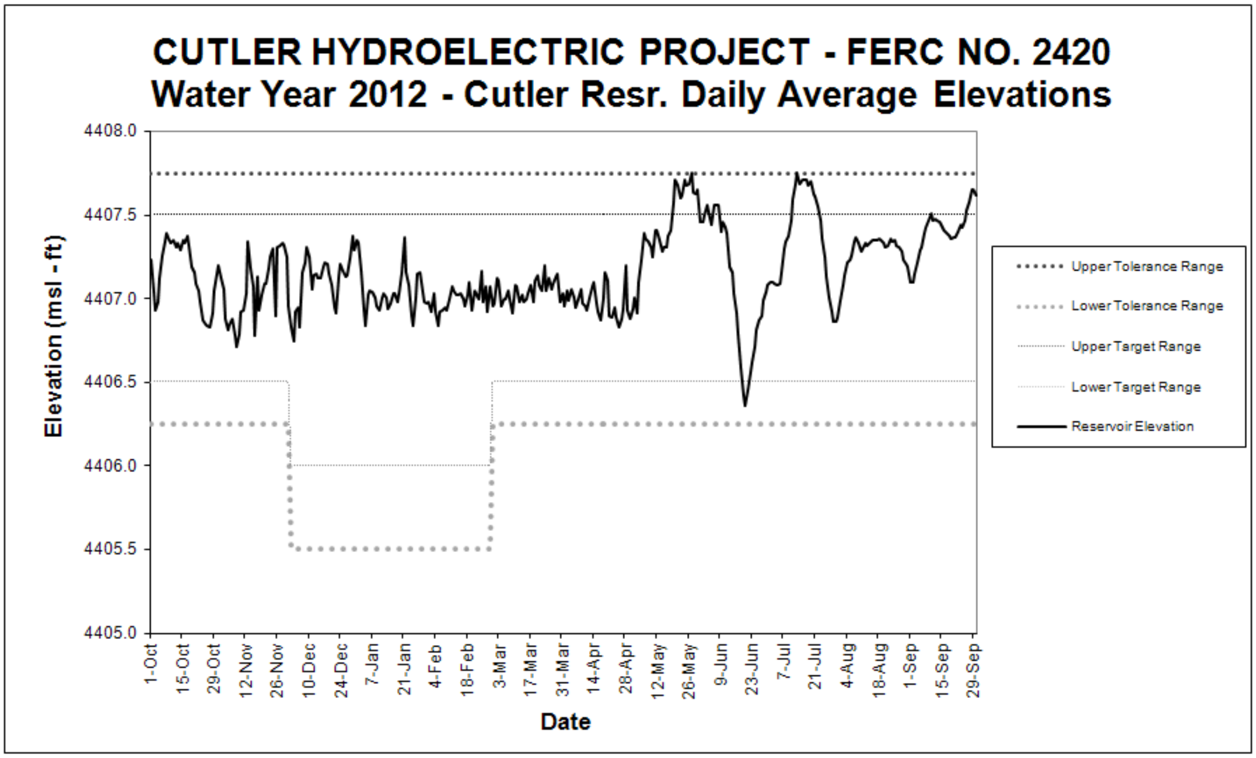


A maintenance drawdown was made in December 1-5, 2009 to repair irrigation head gate stems located on the dam. The planned event was reported to the Portland Regional Office on November 23, 2009 and is not considered a divergence from the approved operating plan.

Also, fluctuations during the summer of water year 2010 resulted from changes in irrigation demand and the adjustments made at the Bear Lake Outlet Canal which has a four-day water travel time to reach Cutler Reservoir.



Water year 2011 was extraordinarily wet and resulted in high runoff operations at Cutler for an extended period of time in the spring, operating lower than usual to reduce downstream peak flows during the vigorous snowmelt runoff period.



Fluctuations during the summer of water year 2012 resulted from changes in irrigation demand and the adjustments made at the Bear Lake Outlet Canal which has a four-day water travel time to reach Cutler Reservoir.

APPENDIX I

AGENCY CONSULTATION

PACIFICORP ENERGY
A MIDAMERICAN ENERGY HOLDINGS COMPANY

1407 West North Temple
Salt Lake City, Utah 84116

February 22, 2013

Subject: Cutler Hydroelectric Project, FERC No. P-2420
5-year Monitoring Report for the Article 402 Resource Management Plan

Enclosed is PacifiCorp Energy's draft 5-year Monitoring Report for the Cutler Hydroelectric Project's Resource Management Plan (RMP). The report is required by the Project's Federal Energy Regulatory Commission (FERC) license (Article 402) and documents resource management plan activities and monitoring conducted from 2008 through 2012.

In an order dated November 6, 1995, the FERC approved the RMP and required that monitoring reports be prepared every five years in consultation with the following parties:

- U.S. Fish & Wildlife Service
- U.S. Forest Service
- Utah Division of Wildlife Resources
- Utah Division of Water Resource
- Utah Division of Parks and Recreation
- National Park Service
- Bear River Canal Company

By FERC order, the parties' review and comment period is 30 days. The report is due to the FERC on March 31, 2008. Therefore, please review the enclosed draft report and provide your written comments to the following address (by letter or e-mail) no later than March 25, 2013:

Eve Davies, Hydro Resources
1407 W. North Temple Street, Suite 110
Salt Lake City, Utah 84116
eve.davies@pacificorp.com
Fax: (801)220-4748

If you have any questions or comments about the report, please contact me at 801-220-2245 or by cell at 801-232-1704. Thank you in advance for your time and consideration of this matter.

Sincerely,

Eve Davies, Principal Scientist
Hydro Resources, PacifiCorp Energy

U.S. FISH AND WILDLIFE SERVICE

From: Burns, Melissa [mailto:melissa_burns@fws.gov]
Sent: Wednesday, March 20, 2013 10:59 AM
To: Davies, Eve
Cc: Kevin McAbee
Subject: Cutler Hydroelectric Project 5-year Monitoring Report

Dear Eve,

Thank you for the opportunity to review the Cutler Hydroelectric Project, FERC No. P-2420 5-Year Monitoring Report for the Article 402 Resource Management Plan.

General Comments

Overall, the document contains a well-defined list of programs along with the progress associated with each item (Table ES-1). The document is well written and comprehensive, giving the reader sufficient information to understand the findings and recommendations within the report.

Specific Comments

Page 50, 2nd paragraph, lines 5 and 6: The term "extremely" is used twice to denote growth of shrub and willow plantings. Specific terminology should be used to quantify the success of the plantings. For example, a range of heights could be provided so the readers have a solid understanding on the the vegetation in its current state.

Page 65, last paragraph, first sentence: Change "Minor concerns noted through monitoring in" to " Concerns noted during monitoring included...".

Page 68, 1st paragraph, second sentence: The sentence should be reworded. The word "noted" is used three times.

Page 69, 1st paragraph: Please define the threshold at which angler use will be adequate for data to be collected. Has this number been determined by UDWR? If so, the information should be included in the document.

Appendix B-1, B-12, Table B-1-4: A statement should be added to this section clarifying why phragmites has been excluded from the inventory.

Appendix B-1, B-13, 2013 Integrated Weed Management Strategies, 1st sentence: Who is Provida? Please clarify.

Appendix B-1, B15-B19: The legends in the figures provided aren't legible.

Appendix B-2: A short, descriptive paragraph should be added to this appendix.

Appendix B-3: A short, descriptive paragraph should be added to this appendix.

Appendix C: This appendix should be renamed. Currently, it only provides information about white-faced ibis although the title infers data will be provided about the wide range of species using the project area (e.g. long-billed curlew, American avocet, and black-necked stilts).

Appendix D: A short, descriptive paragraph should be added to this appendix.

Appendix D: There are issues with the page numbers in this section. Pages are numbered D-1, D-2, D-1, D-2, D-3. Please correct.

Appendix D: Page D-12 starts in mid-sentence. It appears to have been included in this section accidentally. Please correct or remove as needed.

We appreciate the opportunity to provide these comments and are available to provide support and technical assistance at your request. If further assistance is needed or you have any questions, please contact Melissa Burns, Ecologist, at (801) 975-3330 extension 123.

Thank you,

Melissa

--
Melissa Burns
Habitat Conservation Ecologist, Ecological Services
United States Fish and Wildlife Service
2369 West Orton Circle, Suite 50
West Valley City, UT 84119
Office: 801-975-3330 x 123
Fax: 801-975-3331
Melissa_Burns@fws.gov

PACIFICORP RESPONSE TO U.S. FISH AND WILDLIFE SERVICE COMMENTS
Responses appear in italics

General Comments

Overall, the document contains a well-defined list of programs along with the progress associated with each item (Table ES-1). The document is well written and comprehensive, giving the reader sufficient information to understand the findings and recommendations within the report.

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Page 50, 2nd paragraph, lines 5 and 6: The term "extremely" is used twice to denote growth of shrub and willow plantings. Specific terminology should be used to quantify the success of the plantings. For example, a range of heights could be provided so the readers have a solid understanding on the the vegetation in its current state.

More specific detail was added to describe how shrub establishment and growth is quantified (i.e., willow stems enumerated as '100' for 'continuous' in the data counts once there are >100 stems/m, linearly).

Page 65, last paragraph, first sentence: Change "Minor concerns noted through monitoring in" to " Concerns noted during monitoring included...".

Change incorporated.

Page 68, 1st paragraph, second sentence: The sentence should be reworded. The word "noted" is used three times.

Sentence reworded as follows:

Also note that additional and more recent fishery monitoring efforts by USU aquatic ecology professors and students reflect greater diversity than believed, but also describe a very eutrophic and potentially deteriorating system due to human impacts on water quality and ecology at Cutler.

Page 69, 1st paragraph: Please define the threshold at which angler use will be adequate for data to be collected. Has this number been determined by UDWR? If so, the information should be included in the document.

This supplemental information was included in Section 1.1.5, Fish Habitat Enhancement Monitoring Program:

PacifiCorp staff discussed this comment with the Division's Northern Region Fisheries Manager (P. Thompson, pers. comm. 2013). The Division noted that they still believe the angler use levels are insufficient to warrant the surveys, but further that angler surveys are generally done to *address a specific management issue or question, and that the 'triggering event' would be the issue or question, and not really angler numbers (i.e., questions about the fishing experience at a particular location meeting the goals for that waterbody). If questions regarding the matter still remain, PacifiCorp and UDWR recommend meeting in 2013 to address the issue.*

Appendix B-1, B-12, Table B-1-4: A statement should be added to this section clarifying why phragmites has been excluded from the inventory.

The following statement was footnoted in Table B-1-4:

"Note that this inventory did not include the invasive common reedgrass, Phragmites australis as it is not currently listed as a noxious weed by the county."

However, PacifiCorp is working with Utah State University to determine which Phragmites in the area may be the native grass, versus which may be the invasive non-native grass. This determination may help guide future management of invasive species.

Appendix B-1, B-13, 2013 Integrated Weed Management Strategies, 1st sentence: Who is Provida? Please clarify.

Providia is a consultant to PacifiCorp and the company that prepared the weed management report included in Appendix B-1. A cover sheet has been added to the report that identifies Providia as the preparer.

Appendix B-1, B15-B19: The legends in the figures provided aren't legible.

The figures in Appendix B-1 have been increased to 11 x 17 inch size to help with legibility.

Appendix B-2: A short, descriptive paragraph should be added to this appendix.

This statement was added to the Appendix B-2 title page:

Table B-2-1 presents a summary of the condition of each of the bank stabilization sites created as part of the vegetation enhancement program, including 2002 (baseline) and 2008-2012 data.

Appendix B-3: A short, descriptive paragraph should be added to this appendix.

This statement was added to the Appendix B-3 title page:

Table B-3-1 presents a summary of the condition of the boundary buffer fences monitored as part of the vegetation enhancement monitoring program, 2008-2012.

Appendix C: This appendix should be renamed. Currently, it only provides information about white-faced ibis although the title infers data will be provided about the wide range of species using the project area (e.g. long-billed curlew, American avocet, and black-necked stilts).

The title of the appendix was changed to "Wildlife Monitoring Data." While the data included in this five-year report centers on white-faced ibis, it is anticipated that data for other wildlife species may be included in this section in subsequent reports, similar to previous reports.

Appendix D: A short, descriptive paragraph should be added to this appendix.

The following information was added to the Appendix D title page:

APPENDIX D-1: CLIMATE DATA

- *Climate Data for the Cutler Area by Calendar Year, 2008-2012*
  (Source: Utah Climate Center)

APPENDIX D-2: CUTLER ANNUAL AGRICULTURAL LEASE DATA

- *Summary of Cutler Annual Grazing Animal Unit Month (AUM) and Farm Lease Data*

APPENDIX D-3: CATTLE MANAGEMENT FENCE MONITORING DATA

- *Summary of Cattle Management Fence Monitoring Results by Year, 2008-2012*

APPENDIX D-4: PROPERTY INCIDENT SUMMARY DATA

- *Summary of PacifiCorp's Property Incident Forms for the Current Monitoring Period, 2008-2012.*

Appendix D: There are issues with the page numbers in this section. Pages are numbered D-1, D-2, D-1, D-2, D-3. Please correct.

This has been corrected.

Appendix D: Page D-12 starts in mid-sentence. It appears to have been included in this section accidentally. Please correct or remove as needed.

This page has been removed.

U.S. FOREST SERVICE

USDA United States Department of Agriculture | Forest Service | Uinta-Wasatch-Cache National Forest Logan Ranger District | 1500 E. Hwy. 89 Logan, UT 84321 435-755-3620

File Code: 2720
Date: 02/25/2013

Eve Davies
Principal Scientist, Hydro Resources
PacifiCorp Energy
1407 W. North Temple, Suite 110
Salt Lake City, UT 84116

Dear Eve,

I am in receipt of the Cutler Hydroelectric Project, FERC No. P-2420 5-year Monitoring Report for the Article 402 Resource Management Plan documenting resource management plan activities and monitoring conducted from 2008 through 2012.

After reviewing this document, the USDA Forest Service, Logan Ranger District has no further comments. The entire Cutler Hydrologic Project is located below the National Forest and has no influence on activities or resources that occur on the Forest.

If you have any questions regarding these comments, please contact Paul Chase at (435) 755-3620.

Sincerely,

Jennefer Parker

Jennefer Parker
Logan District Ranger

Caring for the Land and Serving People

Printed on Recycled Paper

UTAH DIVISION OF WILDLIFE RESOURCES

GARY R. HERBERT
Governor

GREGORY S. BELL
Lieutenant Governor

State of Utah

DEPARTMENT OF NATURAL RESOURCES

MICHAEL R. STYLER
Executive Director

Division of Wildlife Resources

GREGORY SHEEHAN
Division Director

March 15, 2013

Eve Davies, Hydro Resources
Pacificorp Energy
1407 West North Temple Street, Suite 110
Salt Lake City, Utah 84116

Subject: Comments on Cutler Reservoir 5-year Monitoring Report and RMP

Dear Eve:

The Utah Division of Wildlife Resources approves of Pacificorp's proposal to suspend monitoring of fish habitat that was installed as part of the fish habitat structure program in the mid 1990s. Because of the age of these structures, future monitoring is not warranted. While the structures installed do provide some benefits to recreational anglers as fish attractors, they provide little benefit to the fish community in terms of population enhancement. When Cutler Dam is scheduled for relicensing, our office would like to sit down and discuss potential options for additional fish habitat structures in Cutler Reservoir. We have no additional comments on the 5-year Monitoring Report and RMP.

Sincerely,

Paul Thompson
Utah Division of Wildlife Resources
Northern Region Aquatics Manager
801-476-2771

cc Chris Penne
Drew Cushing

1594 West North Temple, Suite 2110, PO Box 146301, Salt Lake City, UT 84114-6301
telephone (801) 538-4700 • facsimile (801) 538-4709 • TTY (801) 538-7458 • www.wildlife.utah.gov

UTAH STATE PARKS AND RECREATION

From: Susan Zarekarizi [mailto:susanzarekarizi@utah.gov]
Sent: Wednesday, March 27, 2013 8:56 AM
To: Davies, Eve
Cc: Fred Hayes; Dave Harris
Subject: Re: Cutler Monitoring Report

On behalf of Utah State Parks and Recreation, I have reviewed your report and have no comments or changes other than great job. I'm impressed by your monitoring program and successes at this reservoir. I had no idea PacifiCorp developed a canoe maze. This is a great idea and a fun way to spend the day on the water.

Thanks,

Susan Zarekarizi
Utah State Parks and Recreation
Lands/Environmental Coordinator
Phone: 801-538-7496
Fax: 801-538-7378
susanzarekarizi@utah.gov

UTAH DIVISION OF WATER RESOURCES

From: Dennis Strong [mailto:dennisstrong@utah.gov]
Sent: Tuesday, March 26, 2013 8:58 PM
To: Davies, Eve
Subject: Re: Cutler Monitoring Report

We have no comments.

BEAR RIVER CANAL COMPANY

Date: Thu, 28 Mar 2013 16:01:40 -0600 [04:01:40 PM MDT]
From: "brcanal.darin" <brcanal.darin@frontier.com>
To: Eve.Davies@PacifiCorp.com
Cc: yazoo@xmission.com
Subject: RE: FW: Cutler Report....

Eve,

I have received and reviewed your report and apologize that it took so long to reply. It looks fine to me concerning any issues pertaining to the Bear River Canal Co. and I have no comments on it other than I'm grateful I don't have to try and put something like this together.

Sincerely

Darin McFarland
General Manager
Bear River Canal Co