BUREAU OF RECLAMATION

Boise River Basin Feasibility Study

Specialist Report: Water Resources

Boise Project, Idaho

Interior Region 9: Columbia Pacific Northwest

U.S. Department of the Interior

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Mission Statements

The Department of the Interior (DOI) conserves and manages the Nation's natural resources and cultural heritage for the benefit and enjoyment of the American people, provides scientific and other information about natural resources and natural hazards to address societal challenges and create opportunities for the American people, and honors the Nation's trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities to help them prosper.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

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Acronyms and Abbreviations

Acronym or Abbreviation	Meaning
BMP	best management practice
BNF	Boise National Forest
Boise Forest Plan	Boise National Forest Land and Resource Management Plan
cfs	cubic foot per second
CWA	Clean Water Act
DEIS	Draft Environmental Impact Statement
IDAPA	Idaho Administrative Procedures Act
IDEQ	Idaho Department of Environmental Quality
IDL	Idaho Department of Lands
IWRB	Idaho Water Resource Board
NPDES	National Pollutant Discharge Elimination System
Reclamation	Bureau of Reclamation
SWPPP	Stormwater Pollution Prevention Plan
TMDL	total maximum daily load
USACE	U.S. Army Corps of Engineers
USFS	U.S. Forest Service
WOUS	Waters of the United States

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1. Introduction

The Boise River Basin Feasibility Study is an evaluation that provides for an assessment of increasing surface water storage opportunity within the Boise River basin through the increase of storage volume at Anderson Ranch Reservoir. The project is located at Anderson Ranch Reservoir and Dam, the farthest upstream of the three reservoirs within the Boise River system. Anderson Ranch Dam is a zoned earth fill embankment structure that is located 28 miles northeast of the city of Mountain Home in Elmore County, Idaho. The dam and reservoir provide irrigation water, flood control, power generation, and recreation benefits. The reservoir also provides a dead storage pool for silt control and the propagation and habitat for fish and wildlife of the region.

Anderson Ranch Dam is operated by the Bureau of Reclamation (Reclamation). Reclamation, in partnership with the Idaho Water Resource Board (IWRB), proposes to raise the elevation level of Anderson Ranch Dam for increasing the pool volume of the reservoir upstream of the dam. New reservoir storage would provide the flexibility to deliver additional water when available and for later season supply when and where it is needed to meet existing and future water demands. The alternatives analyzed in this document include the No-Action Alternative (Alternative A), a 6-foot raise of Anderson Ranch Dam (Alternative B), and a 3-foot raise of Anderson Ranch Dam (Alternative C). Alternative A provides a basis for comparison with the two action alternatives, Alternatives B and C.

Under Alternative A, current baseline conditions would continue, without an increase in the Anderson Ranch Dam height or construction of the associated reservoir rim projects, access roads, or facilities. Under Alternative A, change in the watershed would only occur through natural process or change related to Reclamation's standard operation and maintenance procedures already in place. Alternative B proposes to raise the dam by 6 feet from the present elevation of 4196 feet to 4202 feet to capture and store approximately 29,000 additional acre-feet of water. Alternative B would inundate an estimated 146 acres of additional land around the reservoir above the current full pool elevation of 4196 feet. Alternative C proposes to raise the dam by 3 feet to 4199 feet, allowing for the ability to capture and store approximately 14,400 additional acre-feet of water. Alternative C would inundate an estimated 73 acres of additional land around the reservoir above the current full pool elevation of 4196 feet. The expected construction durations of Alternative B is approximately 51 months and Alternative C is 44 months. Reclamation would continue existing operations of Anderson Ranch Dam during all construction activities with no interruption of operations during this period.

Each of the two action alternatives, Alternatives B and C, consist of two separate but similar structural construction methods for the dam raise; soil cement or mechanically stabilized earth (MSE). Project areas and construction durations for each construction method is nearly identical to each other, except for a 200 linear-foot difference in approach road length at the right dam abutment and an approximate 1-month difference in construction duration. The longer road length is within the dam footprint of previously disturbed ground. Otherwise, the only difference is the dam raise elevations of 6 feet for Alternative B and 3 feet for Alternative C. Because these construction method variances are negligible, they are not differentiated within the analysis of each alternative. Alternative B and C analysis assume the longer road length and construction duration will be implemented for each alternative however, a final construction method will be chosen during later phases of the engineering evaluation.

Chapters 1 and 2 of the Boise River Basin Feasibility Study Environmental Impact Statement (EIS) provide a detailed description of the proposed action, project's purpose and need, project area, and alternatives including design features applicable to the action alternatives. This technical report supports the analysis of expected impacts on water resources as described in the EIS.

1.1 Regulatory Framework

1.1.1 Federal

Clean Water Act

The Clean Water Act (CWA) of 1972, as amended, is the major federal legislation governing water quality for the project and establishes the basic structure for regulating discharge of pollutants into the Waters of the United States (WOUS). Below are the sections of the Act that apply directly to the proposed action.

Section 303 – Water Quality Standards and Impaired Waterways

This section of the CWA requires states to adopt water quality standards for all surface waters of the United States. Section 303(d) of the CWA requires states to develop a list of water quality-impaired segments of waterways that do not meet water quality standards necessary to support the beneficial uses of that waterway. Section 303(d) of the CWA also requires states to maintain a listing of impaired water bodies so that a total maximum daily load (TMDL) can be established. A TMDL is a plan to restore the beneficial uses of a stream, or to otherwise correct an impairment. Idaho Department of Environmental Quality (IDEQ) develops TMDLs for state of Idaho.

Section 402 – National Pollutant Discharge Elimination System

This section of the CWA requires all point sources that discharge into WOUS to obtain a National Pollutant Discharge Elimination System (NPDES) permit. The NPDES permit process also provides a regulatory mechanism for the control of nonpoint source pollution created by runoff from construction and industrial activities. Projects involving construction and ground disturbance more than 1 acre must file a Notice of Intent with IDEQ to indicate their intent to comply with the NPDES Construction Stormwater General Permit. This permit establishes conditions to minimize sediment and pollutant loadings and requires preparation and implementation of a Stormwater Pollution Prevention Plan (SWPPP) before construction and ground disturbance can begin. The SWPPP is intended to help identify the sources of sediment and other pollutants, and to establish best management practices (BMPs) for stormwater and non-stormwater source control and pollutant control.

Section 404 – Discharge of Dredged or Fill Material into Waters of the United States

This section of the CWA authorizes the U.S. Army Corps of Engineers (USACE) to regulate discharges of dredged or fill material into WOUS through Section 404(b)(1) guidelines of the CWA. In accordance with Section 404 of the CWA, a permit must be obtained from USACE for any discharge of dredged or fill material into WOUS.

Section 401 – Water Quality Certification

This section of the CWA requires an applicant for any federal license or permit (e.g., Section 404 permit) that may result in a discharge into WOUS to obtain a certification from IDEQ that the discharge would comply with provisions of the CWA. This provides the state to have input into federally approved projects and to ensure that projects would comply with state water quality standards. Any Section 401 certification in Idaho also ensures that the project would not adversely impact impaired waters and complies with applicable TMDL plans. Any condition of a 401 water quality certification would be incorporated into the Section 404 permit.

National Environmental Policy Act of 1970 (42 U.S.C. 4321-4347)

The National Environmental Policy Act (NEPA) was passed in 1969 and was signed into law in 1970. The Act required federal agencies to prepare environmental documentation (EIS, EA, CEs) for all major Federal actions that could affect the human environment. NEPA also established the Council on Environmental Quality (CEQ). NEPA provides for a broad framework of protecting the environment and assures that the proposed actions considered give proper attention to the environment prior to undertaking of any major federal action that may significantly affect the environment.

Safe Drinking Water Act of 1974, as amended (42 U.S.C. 300 et. Seq.)

The Safe Drinking Water Act (SDWA) was established to protect the quality of drinking water in the U.S. This law focuses on all waters designed for drinking use, whether from above ground or underground sources, current or potential sources of drinking water. The Act established minimum primary standards to protect drinking water. The State may also establish secondary water quality standards.

National Forest Management Act of 1976 (Public Law 94-588)

The National Forest Management Act is an amendment of the Forest and Rangeland Renewable Resources Planning Act of 1974, which called for the management of renewable resources on national forest lands. This act requires the U.S. Forest Service (USFS) to assess forest lands, develop a management program based on multiple-use, sustained-yield principles, and implement a land and resource management plan for each unit of the National Forest system. It is the primary statute governing the administration of national forests.

Boise National Forest Land and Resource Management Plan

The Boise National Forest (BNF) Land and Resource Management Plan (Boise Forest Plan) is a forest-wide land use plan that guides management activities on lands administered by the BNF. It describes management goals and objectives, resource protection methods, desired resource conditions, and the availability and suitability of lands for resource management. Originally released in 1990, the forest plan was revised in 2003 and most recently updated in 2010 (USFS, 2010).

1987 Master Interagency Agreement

The Bureau of Reclamation (Reclamation) and USFS cooperatively manage land in the Boise River Project area under the 1987 Master Interagency Agreement between the two agencies, which provides guidance at a national level (USFS and Reclamation, 1987). This agreement establishes procedures for planning, developing, operating, and maintaining Reclamation water projects located on or affecting the lands and resources administered by the National Forest. This includes facilitating coordination and cooperation with USFS for orderly development, management, and administration of federal resources within areas of mutual interest and/or responsibility.

1.1.2 State

Idaho Administrative Code 58.01.02

Idaho Administrative Code (Idaho Administrative Procedures Act [IDAPA]) is a compilation of all final and temporary administrative rules that have been promulgated and adopted in accordance with the requirements of IDAPA. Beneficial uses and water quality criteria and standards are identified in IDAPA 58.01.02 Water Quality Standards. Other IDAPA rules that are applicable to water resources in the state of Idaho are the Idaho Groundwater Quality Rule (IDAPA 58.01.11), Idaho Environmental Protection and Health Act of 1972 (Title 39, Chapters 1 and 36), Individual/Subsurface Sewage Disposal Rules (IDAPA 58.01.03), and Idaho Well Construction Rules (IDAPA 37.03.09).

Idaho Forest Practices Act (Idaho Code 38-1301 to 1313)

The Idaho Forest Practices Act requires the Idaho State Board of Land Commissioners to adopt rules describing minimum forest practice standards. This act gave the board authority to adopt rules designed to assure the continuous growth and harvest of timber resources, and at the same time protect and maintain soil/air/water quality, wildlife, and aquatic habitat, as described in Idaho Department of Lands (IDL) Forest Practice Rules Guidance (IDL, 2018). These rules include road construction, reconstruction, and maintenance standards, and guidelines to maintain water quality.

Idaho State Water Plan

The Idaho Comprehensive State Water Plan was adopted by the Idaho Water Resource Board (IWRB) to guide the development, management, and use of the state's water and related resources. Originally drafted in 1976, it was most recently revised in 2012 to reflect changes in water supply and demand in Idaho (IWRB, 2012). Idaho legislature recognizes the exclusive authority over the appropriation of public surface and ground waters of the state and this authority is vested in the Department of Water Resources (Idaho Code 42-201[7]) and requires that the plan be consistent with state law. This plan includes constraints to protect water quality.

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2. Affected Environment

The affected environment related to the water resources for the proposed alternatives under the Boise River Basin Feasibility Study are addressed in this section. Anderson Ranch Reservoir is located on the South Fork Boise River within the BNF, approximately 28 miles northeast of Mountain Home, Idaho, and 32 miles upstream from Arrowrock Dam. The reservoir has a current storage capacity of 413,074 acre-feet at full pool (4196 feet elevation). At this height, the surface area of the reservoir is 4815 acres, is about 17 miles long, and has a shoreline of approximately 50 miles.

The project area relating to Alternative B and Alternative C refers to the general vicinity in and around Anderson Ranch Reservoir extending downstream to the extent of Arrowrock Dam, via the South Fork Boise River. The area of analysis of water resources, including water quality, aquatic life, and designated beneficial uses encompass the Anderson Ranch Reservoir and the lower portion of its tributaries, the South Fork Boise River immediately upstream of Anderson Ranch Reservoir, and the South Fork Boise River between Anderson Ranch Dam and Arrowrock Reservoir. The area of analysis for groundwater impacts is the area around the reservoir where the elevated reservoir pool could impact groundwater elevations, groundwater wells, and onsite septic systems (OSS). Additionally, any spill or release of hazardous chemicals, fluids, or substances during any construction activities or traffic accidents could have impact upon the groundwater resource. See the Hazardous and Toxic Materials report for discussion regarding the handling, storage, and transport of hazardous and toxic materials.

2.1 Surface Water Setting

The area of Anderson Ranch Reservoir is a mountainous region having moderate to steep relief with nearby peaks rising up to 1200 feet above the narrow alluvium valley floors. The regional topography is that of moderate to steep slopes of dissected fluvial lands, formed by stream dissection and weathering (Wendt, 1973). Surface water tributaries of the Anderson Ranch Reservoir have moderate to steep stream gradients. The steep landforms and gradients present in the basin provide high energy potential within the stream and the impetus for potential erosional scour. This potential corresponding with the presence of granitic rock, which is highly erodible rock from both chemical and mechanical weathering processes, disaggregates the rock on the steep slopes of the basin. The erosion rates in the vicinity of Anderson Ranch Reservoir are high and mass wasting on slopes occurs often in the basin.

Most of the basin's annual precipitation occurs in the upper elevations as snow, and because of this, larger amounts of seasonal flow occur from snow melt. Intense summer storms may also produce high flow events. Water flow paths through the mountain downslope terrain occur across a number of partitions including overland flow, baseflow through the thin soil layer, and deep percolation into the fractured bedrock of the mountain block. Overland flow in the tributaries allows for recharge into the shallow mountain block subsurface, which generally occurs in the upper portions of the basin. Recharge to the alluvial aquifer occurs at piedmonts or fans of decreasing slope and increasing porosity as overland flow flows across the surface of these features. Baseflows would also discharge directly into the alluvial aquifers at the interface of the mountain block and the shallow aquifer.

2.2 Surface Water Quality

Water quality standards and designated beneficial uses for Anderson Ranch Reservoir, its tributaries, and the South Fork Boise River between Anderson Ranch Reservoir and Arrowrock Dam are identified in the Idaho Water Quality Standards (IDAPA 58.01.02), and the status of attaining water quality standards and supporting designated beneficial uses are reported in *Idaho's 2016 Integrated Report* biannual report (IDEQ, 2018). The most recent parameters for surface water quality are presented in Table 1 below. Anderson Ranch Reservoir does not support cold water aquatic life, and salmonid spawning. It also is not fully supporting secondary contact recreation beneficial use due to water quality impairment from mercury (IDEQ, 2018). All stream tributaries to Anderson Ranch Reservoir are either fully supporting their designated beneficial uses or have not yet been assessed, with the exception of Lime Creek. Lime Creek does not support cold water aquatic life and salmonid spawning beneficial uses because of water quality impairment from temperature (IDEQ, 2018).

According to IDEQ, a Total Maximum Daily Load (TMDL) has been developed for the Anderson Ranch Reservoir as the water body does not meet water quality standards for waters of Idaho for secondary contact recreation because standards for mercury have been exceeded. A complete description of this TMDL is described in the Water Quality Specialist Report included in Appendix B. A temperature TMDL that specifies specific shade targets for individual reaches of Lime Creek has been approved (IDEQ, 2008). The reach of Lime Creek above Lime Creek Bridge that would be affected by the project is identified in the TMDL as having 0% existing shade, a shade target of 0%, and meeting its 0% shade target (IDEQ, 2008). An exception to this shade target goal is the slack water area directly adjacent to the confluence of Lime Creek with Anderson Ranch Reservoir. Based upon aerial photography analysis, this 800-foot length of lower Lime Creek has 0% shade present, has a shade target goal of 30% and is -30% not reaching the shade goal. The South Fork Boise River between Anderson Ranch Dam and Arrowrock Reservoir is fully supporting cold water aquatic life, salmonid spawning, and primary contact recreation beneficial uses.

Table 1. Designated beneficial uses, status, and impairment for surface water bodies in the study area

Water Body	Aquatic Life and Recreation Designated Beneficial Uses[1]	Status	Impairment
Anderson Ranch Reservoir	Cold, SS, PCR, SCR	Not Supporting Cold, SS, SCR	Mercury
South Fork Boise River - Willow Creek to Anderson Ranch Reservoir	Cold, SS, PCR	Fully Supporting All	
South Fork Boise River - Anderson Ranch Dam to Arrowrock Reservoir	Cold, SS, PCR	Fully Supporting All	
Little Camas Creek - Little Camas Dam to Anderson Ranch Reservoir	Undesignated	Not Assessed	
Lime Creek - Source to Anderson Ranch Reservoir	Cold, SS, SCR	Not Supporting Cold, SS	Temperature
Deer Creek - Source to Anderson Ranch Reservoir	Cold, SS, SCR	Fully Supporting All	
Fall Creek - Source to Mouth	Cold, SS, PCR	Fully Supporting All	
Wood Creek - Source to Mouth	Cold, SS, PCR	Fully Supporting All	
Wood Creek - Source to Anderson Ranch Reservoir	Undesignated	Not Assessed	
1st and 2nd Order Tributaries to Anderson Ranch Reservoir	Cold, SS, PCR, or Undesignated	Fully Supporting All or Not Assessed	

1 Cold = cold water aquatic life; SS = salmonid spawning; PCR = primary contact recreation; SCR = secondary contact recreation.

Source: IDAPA 58.01.02; IDEQ, 2018.

2.3 Hydrogeological Setting

Groundwater in the Project Area occurs within two general hydrogeologic units consisting of: 1) unconsolidated aquifers comprised of relatively permeable alluvial deposits residing nearest to the surface, and 2) a fractured bedrock aquifer system, with fractures either exposed at the surface or overlain by alluvial deposits. In spatial relationship in a basin, the Quaternary-aged aquifers in a stream valley alluvium generally occur along creeks, rivers, and other major drainages in the basin. These alluvial aquifers typically overlie the Tertiary-aged batholith formations. The unconsolidated deposits of silt, sand, and gravel occur as floodplains, stream terraces, and alluvial fans, and are generally unconfined. This near-surface alluvium is coarse-grained with substantial amounts (20-50%) of rock fragments (Wendt et al 1973). Surface water baseflow may also recharge directly to the fractured bedrock of the mountain block if the fractures of the mountain block are present in the downslope profile. Mountain-front recharge in semi-arid regions of the mountainous regions is considered a significant component to recharge of the aquifers of a basin (Wilson and Guan 2004).

Groundwater flow in the unconfined alluvial aquifer would generally mimic local topography with flow occurring in the downslope direction and ultimately moving toward the tributary stream channels. The only sedimentary deposits in the Project Area are the narrow strips of coarse alluvium found along the present stream courses. This material would be derived directly from the deposition of bedload material during flood and overland flow events and recent (Quaternary-aged) deposition would include both fine-grained sediment material as well as larger material such as cobble and boulders.

The fractured bedrock hydrogeology of the region near the Anderson Ranch Reservoir is located within a very complex geologic setting dominated by granitic and granodiorite rocks of the Idaho Batholith and younger-aged emplaced plutons. The project area is mapped in the Cretaceous-aged granites and granodiorites of the southern portion of the Atlanta Lobe of the Idaho Batholith with biotite being the principal mafic constituent (Bennett, 2001). Rocks of Eocene-aged Challis Volcanics are also present near the northwest portion of the Reservoir, just west of Lime Creek Road (Bennett 2001). Near the Anderson Ranch Reservoir, a sequence of Miocene lacustrine deposits overlies the Challis Volcanic material.

Tertiary-aged pluton emplacement within the mass of the existing Cretaceous-aged batholith produced structural deformation of the existing country rock. The overlying batholithic material is volumetrically expanded by the pluton emplacement. This expansion forces the crustal material to extend laterally by plastic flow and initiating a thinning and flattening of the continental crust. This structural mechanism forces the upper crustal rocks to be pulled apart into large fault blocks. Bennett (2001) describes that the pluton emplacement into the Idaho Batholith produced a complex sequence of low-angle fractures and faults, which broke the area into a series of rhomboid-shaped blocks that are extensively tilted.

Primary fracture systems in the pluton develop best in flat-lying bodies and the ensuing pattern of fractures is dependent upon the initial shape of the emplaced pluton structure. Upon the decoupling of the overlying blocks, the upper crustal roof rocks slide away radially, producing new structural features and exposing the plutonic material to erosional decomposition and transport. Much of the present regional topographic appearance of the project area is related to extensional faulting. Fractures occur on planes along which the rock materials have lost cohesion while faults are fractures where there has been some appreciable movement along the fractured planes.

Groundwater existing in the fractured granitic bedrock aquifer comprises the main hydrogeologic unit in the project area. Because the inter-grown crystal structure of granite contains very few pore openings, primary permeability and porosity of the bedrock material is considered low. Groundwater occurrence and flow in the fractured granite bedrock is controlled predominantly by the secondary permeability associated with the density, extent, aperture size, and interconnectedness of joints, faults, and fractures present in the rock material. According to Briar et al. (1996), deep sub-terrain groundwater flow between basins in the intermountain region of the basin and range extensional block faulting does not readily occur. Recharge to the fractured bedrock is therefore directly from within the individual basin.

Permeability in the bedrock fractures, as stated above, has been reported to decline dramatically as the depth below the ground surface increases. This is in contrast to unconsolidated alluvial material where permeability is controlled by the size, orientation, and packing of interconnected pore spaces.

A search of the Project Area for existing well logs was completed using the Idaho Department of Water Resources (IDWR) *Find a Well Map* provided by IDWR (https://idwr.idaho.gov/wells/find-a-well.html). All wells completed since 1987 have a well log in the well log records. Any well drilled before that time was not required to have a well log filed but some older well logs do exist in the agencies well log files.

According to the well log information for wells located near the project area, wells are either completed in an unconfined alluvial aquifer, such as wells that are located near the town of Pine, Idaho or within the fractured basalt or granitic rock. The alluvial wells are completed at depths which are generally 100 feet below ground surface or less. Wells located outside of the near-shore areas of the reservoir are generally at much deeper depths and are completed in either basalt or granitic rock material and water is obtained through decomposed or fractured bedrock material. These wells range in depths from approximately 200 to 900 feet below ground surface.

2.4 Groundwater Quality

The EPA has established drinking water standards, both primary and secondary, as required by the Safe Drinking Water Act and the Clean Water Act. These regulations specify maximum contaminant levels (MCLs) and secondary standards for specific contaminants. The MCLs are health-based, while the secondary standards are cosmetic (e.g., skin discoloration) or esthetic effects (e.g., taste). The standards are listed at the site. http://www.epa.gov/safewater/contaminants/index.html#mcls

A search of the U.S. EPA STORET database and the Idaho Department of Water Resource (IDWR) Environmental Data Management System (EDMS) for ground water sampling events reveals limited groundwater sampling has occurred in the region. A single well had been sampled four times in the past two decades (1994-2008) in the region near Pine, Idaho.

Average results of that groundwater sampling event are included in the table below. The well is described as being drilled and completed to a depth of 60 feet below ground surface.

Table 2. Results of Water Quality Sampling completed in GW Wells (432956,1151837, NAD83)

Contaminant	Analytical Results (mg/L)[1]	Primary Standard (mg/L)	Secondary Standard (mg/L, except pH)	Reporting Limit (RL) (mg/L)[2]	Method Detection Limit (MDL)(mg/L)[3]
Arsenic	0.005	0.010		0.0030	0.0004
Barium	0.007	2		0.0020	0.0003
Cadmium	<1.0	0.005		0.0020	0.0004
Chloride	1.74		250	0.20	0.06
Chromium	<0.001	0.1		0.0060	0.0004
Copper	<0.001	1.3		0.010	0.003
Fluoride	0.91		2.0	0.10	0.02
Iron	0.008		0.3	0.060	0.010
Lead	<0.1	0.015		0.00300	0.00006
Manganese	0.008		0.05	0.0040	0.0006
Nitrate	0.265	10			
pH	6.9		6.5 – 8.5		
Selenium	<0.001	0.05		0.00300	0.00032
Sulfate	8.25		250	0.30	0.07
TDS	101		500		
Zinc	0.02		5	0.0100	0.0012

1. Bold indicates exceedance of Primary Standard.
2. Reporting limit is lowest quantification possible with stated precision and accuracy.
3. Minimum detection limit that can be measured with a 99 percent confidence.

Based upon the limited data available from existing sources for water quality in the Anderson Ranch Reservoir area, groundwater quality in the area is suitable for domestic consumption. No water quality standard, either primary or secondary, has an analysis which is above the limit set by the EPA for that analyte.

Four public wells are identified on the IDEQ Source Water Assessment and Protection Website.

- Pine Resort Well No. 1

- Deer Creek Lodge Well No. 1
- USFS Curlew Creek Campground Well No. 1
- Fall Creek Resort Well No. 1

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3. Environmental Consequences

3.1 Methods for Evaluating Impacts

The methods for evaluating impacts to water resources includes a combination of water data and quantitative computer modeling. Impacts to water resources may be short term (1 to 5 years) or long term (more than 5 years), and may be direct (increased pollutant loading), or indirect (changes to streamflow resulting in increased channel erosion). Ammonia, bacteria, and pH water quality parameters are not expected to be affected by the project and are eliminated from further consideration. Temperature criteria for bull trout are not applicable because the project area elevation is lower than the threshold elevation of 4593 feet for applicability to the species.

The impacts to groundwater because of the planned increase in the reservoirs maximum pool were evaluated. These impact indicators were effects to the existing groundwater quality, OSS systems, groundwater wells, and possible construction spills or releases. The analysis area includes the drinking water wells and OSS's located near the reservoir where changing reservoir and groundwater levels could be affected.

The newly inundated areas must meet the State of Idaho separation distance of 50 feet for a septic tank from any permanent surface water (IDAPA 58.01.03) as mandated to protect surface water quality. The vertical separation distance is a product of seasonal variation in ground water table level and soil type and therefore, the OSS on parcels inundated by the higher reservoir level would need Idaho Department of Health verification of requirements for vertical separation of the OSS and the water table on an individual basis. Seasonal high-water vertical separation distance is established at 2 feet for a septic and 1 foot of separation for a drain field.

Impacts to water quality would be significant if the proposed alternatives violate Idaho State Water Quality Standards promulgated to protect designated beneficial uses, or otherwise substantially degrade water quality, or result in water quality changes that would adversely affect designated beneficial uses (Table 10). Impacts to groundwater would be significant if the proposed alternatives contributed to exceedance of primary or secondary EPA drinking water standards, violated Idaho DEQ drinking water rules or contributed to groundwater contamination (Table 10).

Assumptions

The following assumptions were made for this analysis.

- The analysis area encompasses Anderson Ranch Reservoir and the lower portion of its tributaries, the South Fork Boise River immediately upstream of Anderson Ranch Reservoir, and the South Fork Boise River between Anderson Ranch Dam and Arrowrock Reservoir.

- Impacts are assessed for the short term (1 to 5 years) and long term (more than 5 years).
- The baseline for the analysis is the existing condition and Idaho State Water Quality Standards.

3.2 Significance Criteria

Impact Indicator	Significance Criteria
Surface Water Temperature	22ºC (71.6ºF) or less with a maximum daily average no greater than 19ºC (66.2ºF) for cold water aquatic life.
Surface water Turbidity	13ºC (55.4ºF) or less with a maximum daily average no greater than 9ºC (48.2ºF) for salmonid spawning.
Surface Water Dissolved Oxygen	Shall not exceed background by more than 50 nephelometric turbidity units (NTUs) instantaneously or exceed 25 NTUs for more than 10 consecutive days.
Changes in water quality of groundwater from inundation of native subsurface material	Increases in levels of primary or secondary standards above EPA drinking water standards
Changes in water levels in groundwater wells near reservoir	Inundation of an existing well from the increase in maximum reservoir pool
Effects to OSS from increased groundwater levels	OSS does not meet minimum setback requirements established by IDEQ

3.3 Direct, Indirect, and Cumulative Impacts

3.3.1 Alternative A – No Action

Under Alternative A, Reclamation would not modify Anderson Ranch Dam to increase storage capacity, storage levels would remain at the current capacity, Reclamation would continue to operate Anderson Ranch Dam under current standing operating procedures and existing water resource characteristics would be maintained Current shoreline and slope erosion rates would continue and would not be expected to shift existing conditions over the long-term. Any changes to the dam, reservoir, or infrastructure would occur because of facility operation and maintenance. All of these management activities could include the use of equipment or tools that could produce a leak, spill, or release of a hazardous or toxic material. Reclamation BMPs planned before the onset of the work would be sufficient to address any minor leak, spill, or release. Therefore, any activity planned under the No Action Alternative are not anticipated to have any impacts upon the groundwater resources. The No Action Alternative would not have an anticipated impact upon reservoir water quality or levels over the long term.

3.3.2 Alternative B – Anderson Ranch Dam Six-foot Raise

Inundation

Under Alternative B, the proposed full pool elevation of Anderson Ranch Reservoir would increase 6 feet with a full pool elevation of 4202 feet and result in an additional 146 acres of inundated land (a 3% increase over the existing 4,772 acres of full pool elevation inundated land; 6-foot Dam Raise Engineering Summary, Appendix C).

A 3% increase in inundation acres (Alternative B) is a negligible increase in land area, and new shoreline created by the increased full pool elevation is expected to remain stable and maintain the historical existing angles of natural repose. Shoreline erosion could be exacerbated by the encroachment of the new shoreline bank towards road segments along the reservoir perimeter. Shoreline erosion would be minimized upon the placement of rip rap along existing roadways as part of the proposed action to prevent erosion and protect existing roadway infrastructure.

A 3% increase in inundation acres could result in some streamside tree mortality; however, the percentage of streamside tree mortality associated with a 3% increase in inundation acres would be minimal with a negligible effect on stream shading, and therefore would have a negligible short- and long-term impact on water temperature in Anderson Ranch Reservoir, its tributaries, the South Fork Boise River immediately above Anderson Ranch Reservoir, and the South Fork Boise River between Anderson Ranch Dam and Arrowrock Reservoir.

A small slack water section (approximately 800 feet) of Lime Creek that is directly adjacent to the confluence of Lime Creek with Anderson Ranch Reservoir has 0% shade, has a shade target goal of 30% and is -30% from reaching the shade goal, identified in the Lime Creek TMDL (IDEQ, 2008). The upstream adjoining segment of Lime Creek that would also be affected by the project is identified in the TMDL document as having 30% existing shade, a shade target of 30%, and currently meeting its 30% shade target. Potential tree inundation could occur during periods of full pool elevation. Some trees that are inundated during this period may have streamside tree mortality in this segment of Lime Creek. Tree mortality would be minimal but loss of shade trees in this segment may not meet the TMDL goal of 30% shade cover. The loss of trees or shade in this section of Lime Creek would not have a significant effect on surface water temperatures as the segment of Lime Creek that would be inundated is short in total stream length with negligible short- and long-term indirect impacts to water temperature. Alternative B could have a negative impact on compliance with the existing TMDL. If tree mortality occurs and shade target drops below TMDL specified levels, mitigation measures such as planting water tolerant species would provide the measures for Lime Creek to continue to meet the TMDL target for shade and all other Idaho State Water Quality Standards.

In 2004, Reclamation (Reclamation, 2004) determined that Anderson Ranch Reservoir pool elevations that maintain suitable water quality for migratory bull trout would be maintained 98% of the time, and water quality concerns during these 2% of years would continue to occur only during multiple drought years (when the water volume drops below the conservation pool and temperature and dissolved oxygen levels in the reservoir become unsuitable to bull trout). The elevated pool that may occur under the proposed action has the potential to reduce this anticipated 2% frequency, and no significant adverse impacts to temperature or dissolved oxygen are expected to occur under Alternative B.

Historical hard rock mines above Anderson Ranch Reservoir and dredge mining tailings near Anderson Ranch Reservoir are located too far from the reservoir to be affected under Alternative B and therefore would not contribute additional mercury to Anderson Ranch Reservoir, its tributaries, the South Fork Boise River above Anderson Ranch Reservoir, or the South Fork Boise River between Anderson Ranch Dam to Arrowrock Reservoir.

IDEQ direction is to improve or maintain water quality conditions to fully support current beneficial uses, and a mercury TMDL to improve water quality in Anderson Ranch Reservoir will be developed by IDEQ at a future date.

Downstream Impacts

As described in the Hydrology and Water Operations Specialist Report (Appendix B), baseline conditions indicate high streamflow variation, with little difference in average flow, and some difference in the timing of peak flows when the impact scenarios are compared to the baseline. Minimum stream flows of 300 cubic feet per second (cfs) from September 16 through March 31 and 600 cfs after April 1 would continue to be met. The Hydrology and Water Operations Specialist Report also describes the potential for decreased temperatures during the times of year when water temperatures are the highest, and shows temperatures remaining above 2ºC and below 15ºC over the simulation period. As a result of no significant changes to water temperature or flow from baseline conditions, no adverse impacts to water temperature or dissolved oxygen would occur, channel stability would be maintained, and Idaho State Water Quality Standards would continue to be met in the South Fork Boise River between Anderson Ranch Dam and Arrowrock Reservoir under Alternative B.

Construction Activities

Dam construction (including installing and removing coffering), roadway construction (including bridge and culvert work), and other infrastructure construction below the ordinary high-water mark (OHWM) would release small pulses of sediment into the active reservoir pool. The transport capacity of a flowing stream is defined by discharge rate, channel slope, and channel dimensions while sediment supply is defined by the sediment load and grain size. All characteristic being equal, the stream sediment load and stream bed characteristics are in balance (Fritz, et al. 2018). Any change, such as a pulse release of sediment by the removal of a coffer dam in the river, will change the dynamics of the balance. Stream routing processes transfer sediment in lower gradient streams (channel slopes <10%) by dispersion or wave-like action with annual travel distances of approximately 20 channel stream widths per year (American Fisheries Society 2005). Fine sediment is transported as suspended loads throughout the water column to lower gradient stream segments and is eventually deposited and stored in low velocity pools or stream bed structures. Suspended sediment load persistence in a stream reach is a function of the sediment transport capacity of the reach, with higher velocity streams flows capable of transporting larger volumes of sediment loads.

Release of sediment during dam construction is anticipated to be primarily contained in isolated areas near the construction activities and be limited in volume due to the installation of project Best Management Practices (BMPs). Discrete sediment pulses released in surface waters are dispersed by a combination of both translation and dispersion forces within the stream (Morgan and Nelson 2019). According to Morgan and Nelson, sediment spreading rates decrease through time as a power function and smaller total sediment mass pulses have a spreading rate that decays at a faster rate than larger sediment loads. This decreasing spreading rate of sediment from a source reduces turbidity in space and time from the source of the sediment. Sediment or turbidity released during construction activities in Anderson Ranch Reservoir waters would not be expected to exceed background levels beyond 600 feet of the isolated construction areas. Adverse effects as a result of sediment and turbidity would occur for a short duration and distance from source and not be anticipated to occur at a level that would exceed Idaho State Water Quality Standards for turbidity.

Conservation measures would be defined in final design and outlined in Federal permitting requirements. The project SWPPP would highlight BMPs that would be designed and implemented during and after the proposed construction schedule to protect against sediment releases into surface water resources. The installed BMPs would reduce potential sediment loads to surface waters, through either discrete pulses or continuous sediment releases. The BMPs will be developed to protect water quality which is consistent with the Federal Clean Water Act (CWA) and State water quality programs. Current Reclamation policy directs compliance with required CWA requirements and State regulations and requires the use of BMPs to control nonpoint source pollution to meet applicable water quality standards and other CWA requirements. BMP implementation becomes the primary mechanism for meeting water quality standards from nonpoint source pollution, and direct and indirect impacts to water quality from construction activities under Alternative B would not be significant.

Groundwater Impacts

The increase in the pool level above existing full pool elevations currently in place would occur in the spring and summer months. Water elevations would most likely be below existing maximum pool levels in the later parts of the water year. The change in groundwater levels would coincide with the existing and proposed reservoir water elevations. A maximum pool increase would be associated with a maximum 6-foot rise in groundwater levels near the pool/terrestrial interface. Groundwater elevations would be dependent upon the permeability of the geologic formation near the shoreline.

Increasing the water elevation of the Anderson Ranch Reservoir behind the dam to the proposed 6-foot elevation increase would expose new shoreline of bedrock, including fracture bedrock, to inundation of reservoir pool waters. This increase in water pool elevation would increase the localized hydraulic head of the reservoir pool and the forces acting on the groundwater and that increase in force would cause the water to move into fractures located below the water surface elevation. The potential energy of the hydraulic head at a given point is equivalent to the elevation at a point of measurement as well as the depth of the water column that rises in the reservoir. The height of the water in the reservoir represents the actual energy available to recharge water through aquifer materials or fractures (Fetter, 1988). This increase in hydraulic head would occur throughout the profile of the reservoir pool, with decreasing hydraulic head as you move up the water column until you reach maximum pool level and the hydraulic head is essentially equal to the atmospheric pressure.

Increasing the reservoir pool elevation would also expose bedrock fractures to inundation that were not exposed to the reservoir waters in the past. These fractures would provide a conduit to increased aquifer recharge. The rate of recharge would be dependent upon the properties of fractures described above including the size of the opening, the secondary permeability of the fracture zone, and the extent, aperture, and direction of the existing fractures. Bedrock near the surface and in contact with the reservoir pool would tend to have a higher density of fractures with larger openings. These fractures become fewer and tighter with depth, so that hydraulic conductivity and water yield typically decreases with depth.

This increase aquifer recharge could have a beneficial impact to the aquifer system as a whole but may be limited in areal extent and impact as fractures in bedrock are more prolific near the surface but decrease in extent and porosity with depth, thereby limiting the impact. Increasing the reservoir pool elevation would also increase the hydraulic head throughout the reservoir pool profile with that hydraulic head increase leading to possible increase in aquifer recharge. This aquifer recharge from increased hydraulic head may also be limited in areal extent for the same reason listed above regarding decreasing secondary porosity and fracture extent with depth. The increase in recharge brought about by the increase in the reservoir pool would be temporally limited and cyclical based upon the annual water year. Therefore, the increase in the reservoir pool elevation level may have some benefits to the aquifer system in the area of the reservoir but that benefit may be limited in areal extent and temporal factor associated with full pool conditions.

Septic Systems and Drain Fields

There are no municipal or centralized wastewater service in the Project Area. Wastewater from homes and businesses is treated through OSS's located on individual property parcels. These individual systems rely on the settling and treatment of wastes in the septic tank to complete primary treatment of waste and the drain field/soil area to complete the secondary treatment of wastes. These systems rely on the movement and leaching of effluent into the soil profile and therefore require the presence of unsaturated soils to be effective in the process of waste treatment. Because septic systems treat human waste, inundation of these systems at the full pool height could cause waste concerns, including the spread of bacteria and viruses in groundwater. Inundation of these OSS would make them inoperable and they would be considered out of compliance. A higher water table resulting from the Anderson Ranch Dam Raise would reduce the vertical and horizontal separation distance required between the OSS and the water table.

A visual desktop inspection of properties around the reservoir perimeter was performed as part of the Land, Structure, Infrastructure, and Real Estate Survey and Analysis (summarized in the 6-foot Dam Raise Engineering Summary in Appendix C). This analysis assumed that a septic system would exist where any improved structure is located. Eleven potential septic system locations were identified where increases in reservoir water level could possibly inundate the drain field, septic tank, or both (See Table 3-9 in the Rim Analysis [Jacobs, 2019]). The proposed inundation line of 4,202 ft. was compared to parcel ownership information provided by the Elmore County Assessor's Office to determine setback from property line to the new inundation line.

Fall Creek Resort and Marina operates an OSS under a U.S. Forest Service Permit and would become inundated due to the proposed action. Additional information regarding the facilities and land management status of Fall Creek are included in Appendix C. Impacts of this proposed action to the non-Federal real property would be mitigated during the project implementation, and subject to a future environmental assessment, should the project be determined feasible and the Special Use Permit still be in effect. Potential mitigation activities may include.

- Rebuild existing features to their existing condition
- Relocate existing features to a suitable location
- Compensation

Outside of Fall Creek Resort and Marina, Reclamation does not anticipate that higher reservoir levels would have a negative effect on OSS functionality; therefore, the existing OSS's should have no additional effect on groundwater quality because the OSS would continue to function normally with no increased potential for leaching of contaminants to groundwater. Prior to raising the pool level, Reclamation would identify any OSS that the higher pool level could affect and determine the condition of those systems. If the increased reservoir pool would cause OSS to become noncompliant with horizontal or vertical location requirements, Reclamation would coordinate with the property owner and the Idaho Department of Health to reconstruct, relocate, or modify it.

Groundwater Wells

Utilizing existing records and online mapping tools available from the IDEQ and IDWR, as well as onsite investigation, public and private wells were investigated for potential impacts due to water elevation increase. Impacts would be considered significant if the proposed activities substantially changed groundwater wells or sufficient water supplies from existing entitlements and resources, or new or expanded entitlements. Approximately 20 additional well logs are georeferenced surrounding the reservoir area on the Find a Well Map provided by IDWR (https://idwr.idaho.gov/wells/find-a-well.html). Actual well locations vary greatly as verified by field investigation. Parcel information provided by Elmore County Assessor's Office was used to determine existing setback from property line to the new inundation line. No private groundwater wells were identified within an area of concern and all existing wells would continue to meet setback requirements. Of the 4 public wells located in the Project Area, the USFS Curlew Creek Campground Well No. 1 and the well near the Fall Creek Resort are the only identified well to be affected by the surface water elevation increase. At

Curlew Creek, this is due not to direct inundation of the well but the fact that the road/parking area would need to be relocated in the area of the well and therefore this well would need to be relocated outside of the road/parking area. The Fall Creek Resort and Marina Well would not meet surface water setback requirements. As stated above, impacts of this proposed action to the non-Federal real property would be mitigated during the project implementation, should the project be determined feasible and the Special Use Permit still be in effect.

The likelihood that the top of any given well would be physically inundated is low, given the estimated well locations and local topography. According to IDWR well drilling regulations, all wells are constructed to have well casings which are finished at least 12 inches above existing ground level. Also, according to IDWR regulations, all wells are completed with a grout surface seal to a depth of 18 feet below ground surface to prevent surface water from entering the borehole. Alternative B would not have a negative effect on local aquifers or wells because higher water levels would not decrease aquifer yield or impair well performance.

The effects of construction proposed to occur on the dam as well as all associated activities related to that construction, such as road construction and/or modification, on the hydraulic properties of an aquifer, groundwater flow and discharge are likely to be localized, negligible and temporary and therefore are considered insignificant.

Construction Leaks, Spills, and Releases

All discussion including impacts regarding leaks, spills, and releases of hazardous or toxic materials are covered under the Hazardous Waste and Material Specialist Report included in Appendix B.

3.3.3 Alternative C – Anderson Ranch Dam Three-foot Raise

Inundation

Under Alternative C, the proposed full pool elevation of Anderson Ranch Reservoir would increase 3 feet with a full pool elevation of 4199 feet and result in an additional 73 acres of inundated land (a 1.5% increase over the existing 4,772 acres of full pool elevation inundated land; Appendix C).

A 1.5% increase in inundation acres, approximately half of Alternative B, is a negligible increase in land area. Similar to Alternative B, new shoreline created by the increased full pool elevation is expected to remain stable and maintain the historical existing angles of natural repose. Shoreline erosion could be exacerbated by the encroachment of the new shoreline bank towards road segments along the reservoir perimeter, however it would be less than described for Alternative B. Shoreline erosion would be minimized upon the placement of rip rap along existing roadways as part of the proposed action to prevent erosion and protect existing roadway infrastructure.

A 1.5% increase in inundation acres could result in some streamside tree mortality; however, the percentage of streamside tree mortality associated with a 1.5% increase in inundation acres would be minimal with a negligible effect on stream shading, and therefore would have a negligible short- and long-term impact on water temperature in Anderson Ranch Reservoir, its tributaries, the South Fork Boise River immediately above Anderson Ranch Reservoir, and the South Fork Boise River between Anderson Ranch Dam and Arrowrock Reservoir.

As described for Alternative B, the section the segment of Lime Creek above Lime Creek Bridge that would be affected by the project would see negligible short- and long-term indirect impacts on water temperature due to no anticipated streamside tree mortality. Alternative C would be in compliance with the TMDL and Lime Creek would continue to meet all other Idaho State Water Quality Standards.

Similar to Alternative B, the increase in reservoir volume may have a beneficial impact to temperature and dissolved oxygen levels and may reduce the anticipated 2% frequency of levels in the reservoir become unsuitable to bull trout. Temperature and dissolved oxygen are anticipated to meet Idaho State Water Quality Standards and no significant adverse impacts to temperature or dissolved oxygen are expected to occur under Alternative C.

Historical hard rock mines above Anderson Ranch Reservoir and dredge mining tailings near Anderson Ranch Reservoir are located too far from the reservoir to be affected under Alternative B and therefore would not contribute additional mercury to Anderson Ranch Reservoir, its tributaries, the South Fork Boise River above Anderson Ranch Reservoir, or the South Fork Boise River between Anderson Ranch Dam to Arrowrock Reservoir.

IDEQ direction is to improve or maintain water quality conditions to fully support current beneficial uses, and a mercury TMDL to improve water quality in Anderson Ranch Reservoir will be developed by IDEQ at a future date.

Downstream Impacts

Current operational objectives of the reservoir system would remain consistent with all current downstream flow requirements continuing to be met as described for Alternative B. As a result of no significant changes to water temperature or flow from baseline conditions, no adverse impacts to water temperature or dissolved oxygen would occur, channel stability would be maintained, and Idaho State Water Quality Standards would continue to be met in the South Fork Boise River between Anderson Ranch Dam and Arrowrock Reservoir under Alternative C.

Construction Activities

Impacts due to construction activities for Alternative C are similar to Alternative B. Cofferdam construction is the same as identified for Alternative B however the duration of the restriction period requiring the cofferdam is 35 months, 7 months less than Alternative B. Isolation of in-water work areas in Anderson Ranch Reservoir, in conjunction with standard conservation measures included in Reclamation construction contracts, would limit the release of sediment into the active reservoir pool. Similar to Alternative B, release of sediment during dam construction is anticipated to be primarily contained in isolated areas near the construction activities and be limited in volume due to the installation of project Best Management Practices (BMPs). Discrete sediment pulses are dispersed by a combination of both translation and dispersion forces within the stream and sediment spreading rates decrease through time as a power function. This decreasing spreading rate of sediment from a source reduces adverse effects of turbidity. Adverse effect as a result of sediment and turbidity would not be anticipated to occur at a level that would exceed Idaho State Water Quality Standards for turbidity.

Conservation measures would be defined in final design and outlined in Federal permitting requirements. The project SWPPP would highlight BMPs that would be designed and implemented during and after the proposed construction schedule to protect against sediment releases into surface water resources. The BMPs would reduce potential sediment loads to surface waters and will be developed to protect water quality through practices that are consistent with the Federal Clean Water Act (CWA) and State water quality programs. Current Reclamation policy directs compliance with required CWA requirements and State regulations and requires the use of BMPs to control nonpoint source pollution to meet applicable water quality standards and other CWA requirements. BMP implementation becomes the primary mechanism for meeting water quality standards from nonpoint source pollution sources and direct and indirect impacts to water quality from construction activities under Alternative B would not be significant.

Groundwater Impacts

As described for Alternative B, the change in groundwater levels would coincide with the existing and proposed reservoir water elevations. A maximum pool increase would be associated with a maximum 3-foot rise in groundwater levels near the pool/terrestrial interface. Groundwater elevations would be dependent upon the permeability of the geologic formation near the shoreline. The increase in hydraulic head would occur for Alternative C as described for Alternative B, though at a less intensity.

Newly exposed fractures would provide a conduit to increased aquifer recharge as described for Alternative B although the amount of recharge would be less. The rate of recharge would be dependent upon the properties of fractures described as described for Alternative B. The increase in the reservoir pool elevation level may have some benefits to the aquifer system in the area of the reservoir but that benefit may be limited in areal extent and temporal factor associated with full pool conditions.

Septic Systems and Drain Fields

Potential impacts to septic systems and drain fields are identical to those described for Alternative B and are not repeated here and no significant impacts are identified. Consistent with Alternative B, prior to raising the pool level, Reclamation would identify any OSS that the higher pool level could affect and determine the condition of those systems. If the increased reservoir pool would cause OSS to become noncompliant with horizontal or vertical location requirements, Reclamation would coordinate with the property owner and the Idaho Department of Health to reconstruct, relocate, or modify an existing OSS impacted by the increased level of groundwater.

Groundwater Wells

Potential impacts to groundwater wells are identical to those described for Alternative B and are not repeated here. The Curlew Creek public drinking water well would require relocation and the Fall Creek Resort and Marina well would require mitigation at a later phase of the project as stated for Alternative B. Alternative C would not have a negative effect on local aquifers or wells because higher water levels would not decrease aquifer yield or impair well performance.

The effects of construction proposed to occur on the dam as well as all associated activities related to that construction, such as road construction and/or modification, on the hydraulic properties of an aquifer, groundwater flow and discharge are likely to be localized, negligible and temporary and therefore are considered insignificant.

3.4 Cumulative Impacts

Cumulative effects are analyzed for the Alternative B and Alternative C. Cumulative effects are those that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. The cumulative effects analysis considers projects, programs, and policies that are not speculative and are based on known or reasonably foreseeable long-range plans, regulations, operating agreements, or other information that establishes them as reasonably foreseeable. Reclamation has identified two past projects: Pine Bridge replacement and the Anderson Ranch Dam crest raise for security enhancement. Reclamation has also identified two potential future projects to be considered for the cumulative impact analysis: Cat Creek Energy Project and South Fork Boise River Diversion Project. Additional project proposal information for these is provided in Chapter 2 of the EIS.

The 2018 construction of the Pine Bridge and 2010 crest raise are well removed in time from the proposed 2025 rim projects and dam construction. Any potential sediment releases from construction of the new Pine Bridge or dam raise would not be additive. No other potential direct or indirect impacts effecting water resources are recognized, and no cumulative effects are identified for past actions.

If construction for the action alternatives, Cat Creek Energy and South Fork Boise River Diversion projects were to occur simultaneously, direct and indirect effects to water quality within the analysis area from these projects would not be significant because Idaho State Water Quality Standards would be met for each project through a combination of adherence to federal regulations and project design features.

Long-term, it would be anticipated that the surface water elevation of the reservoir would minimally fluctuate based on pumping operations by one or both of the projects. Using the diversion rates from the water right permits (Table 2 in the Water Rights Specialist Report, Appendix B), for each project, it can be assumed that diverting water from the reservoir would have minimal impact on the surface water elevation of the reservoir. The water right Timing of the diversion would coincide with spring inflows into the reservoir. Fluctuations in surface water elevation would be in saturated areas and not are anticipated to be large enough in scale or frequency to cause additional erosion.

Because the water drafted by South Fork Boise River Diversion or Cat Creek Energy projects would be flood control water, it would be assumed that in high water years, downstream flows would be closer to average water year flow levels. Drafting flood flows for the projects would have a potential negative impact to the banks along South Fork Boise River below the dam by reducing episodical flood occurrence to floodplains. The flood flows aid in the reestablishment of vegetation, sediment and delivery of large woody debris for habitat.

Cat Creek Energy Project proposes to create and fill a new reservoir to the south of Anderson Ranch Reservoir. The South Fork Boise River Diversion Project proposes to pump water into an existing reservoir that is seasonally saturated. There would be some groundwater recharge as a result of these projects with multiple geologic properties influencing the rate of recharge and direction of groundwater flow would not be considered significant when combined with these projects due to the spatial distance.

In summary, due to the requirement of adherence to Idaho State Water Quality Standards for each project during construction, timing and frequency of diversions not likely to cause increased turbidity above baseline, and reduced flood flows in the South Fork Boise River, no short or long-term cumulative impacts are anticipated.

3.5 Mitigation

Possible short-term impacts to water quality could occur during construction activities. The impacts associated with small releases of sediment would be limited temporally and spatially by construction design features and BMPs (see Environmental Commitments Section 3.28 for more details). Methods to minimize sedimentation through dewatering and construction activities would be included in all contracts with appropriate provisions to reduce impacts to water resources. All construction activities would be confined to previously disturbed areas, to the extent practicable, for such activities as work, staging, and storage; borrow areas; waste areas; and vehicle and equipment parking areas to preclude sediment delivery to the reservoir and stream channels and minimize impacts to water quality. Shoreline protection measures would be constructed when the reservoir is drawn down to avoid in-water work. Work would be completed before raising the level of the reservoir.

During final design, Reclamation would investigate the exact locations of existing septic systems and water wells which may be located in or near the area of inundation. Once the locations of this infrastructure are identified, Reclamation would identify any infrastructure, such as an OSS or a well, that would be inundated or would not meet the necessary setback requirements established by existing regulations by the dam raise. Upon identification of this infrastructure, Reclamation would make the determination to remove or replace this infrastructure as necessary. Implementation of this mitigation measure would reduce this impact to groundwater to a less-than-significant level.

The Fall Creek Resort and Marina groundwater well would not meet surface water setback requirements. Impacts of this proposed action to the non-Federal real property would be mitigated during project implementation, should the project be determined feasible and the special use permit still be in effect.

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4. References

American Fisheries Society, 2005. Monitoring Stream and Watershed Restoration. Edited by Philip Roni. Northwest Fisheries Science Center, National Marine Fisheries Service. Bethesda, Maryland.

Bennett, E. H., 2001. The Geology and Mineral Deposits of Part of the Western Half of the Hailey 1° x 2° Quadrangle, Idaho. U. S. Geological Survey Bulletin 2064-W. U.S. Department of Interior, U.S. Geological Survey. http://geology.cr.usgs.gov/pub/bulletins/b2064-w/.

Briar, D.W., S.M. Lawlor, M.A.J. Stone, D.J. Parliman, J.L. Schaefer, E. Kendy. 1996. Groundwater Levels in Intermontane Basins of the Northern Rocky Mountains, Montana and Idaho.

Clean Water Act, 33 U.S.C. § 1251-1387. 1972.

Fetter, C. W. 2001- Applied Hydrogeology. 4th ed. Upper Saddle River, N.J.: Prentice Hall.

Fritz, K.M., K.A. Schofield, L.C. Alexander, M.G. McManus, H.E. Golden, C.R. Lane, W.G. Kepner, S.D. LeDuc, J.E. DeMeester, and A.I. Pollard. 2018. Physical and Chemical Connectivity of Streams and Riparian Wetlands to Downstream Waters: A Synthesis. Journal of American Resource Associates 54(2): 323-345.

IDAPA 58.01.02. Idaho Water Quality Standards and Wastewater Treatment requirements.

Idaho Department of Environmental Quality, 2008. South Fork Boise River Sub-basin Assessment, Total Maximum Daily Load, and Five-Year Review. Boise, ID.

Idaho Department of Environmental Quality, 2019. Technical Guidance Manual, Individual and Subsurface Sewage Disposal Systems. Boise, ID.

Idaho Department of Environmental Quality, 2018. *Idaho's 2016 Integrated Repo*rt. A. Steimke, Water Quality Division, Boise, ID. July. Accessed via: http://air.idaho.gov/media/526431-sf_boise_river_0908.pdf

Idaho Department of Lands, 2018. Forest Practice Rules Guidance. Boise, ID.

Idaho Department of Water Resources, 2019. Well Construction Standards Rules. IDAPA 37.03.09. Boise, ID.

Idaho Water Resources Board, 2012. Idaho State Water Plan. Boise, ID.

Morgan, J.A. and P.A. Nelson, 2019. Morphodynamic Modeling of Sediment Pulse Dynamics. American Geophysical Union, Volume 55, Issue 11 pp. 8691-8707.

Omernik, J.M. and G.E. Griffith. 2014. Ecoregions of the conterminous United States: evolution of a hierarchical spatial framework. Environmental Management 54(6):1249-1266.

Bureau of Reclamation. 2004. *Biological Assessment for Bureau of Reclamation Operations and Maintenance in the Snake River Basin Above Brownlee Reservoir*. U.S. Department of the Interior, Bureau of Reclamation, Boise, Idaho. November 2004.

U.S. Forest Service, 2010. *Boise National Forest Land and Resource Management Plan*. Amended as Boise Forest Plan. Boise, ID.

U.S. Forest Service and Bureau of Reclamation. 1987. Memorandum of Agreement for Administration and Management of Resources, Facilities, Water Surfaces, and Reclamation Zones within the Reservoir Areas of Anderson Ranch, Arrowrock, Deadwood, and Cascade. Boise, ID.

Wendt, G.E., Fisher D., Cole, G. F. 1973. Mountain Home Ranger District Soil Hydrologic Reconnaissance. Intermountain Region, Boise National Forest, Mountain Home Ranger District. Mountain Home, ID.