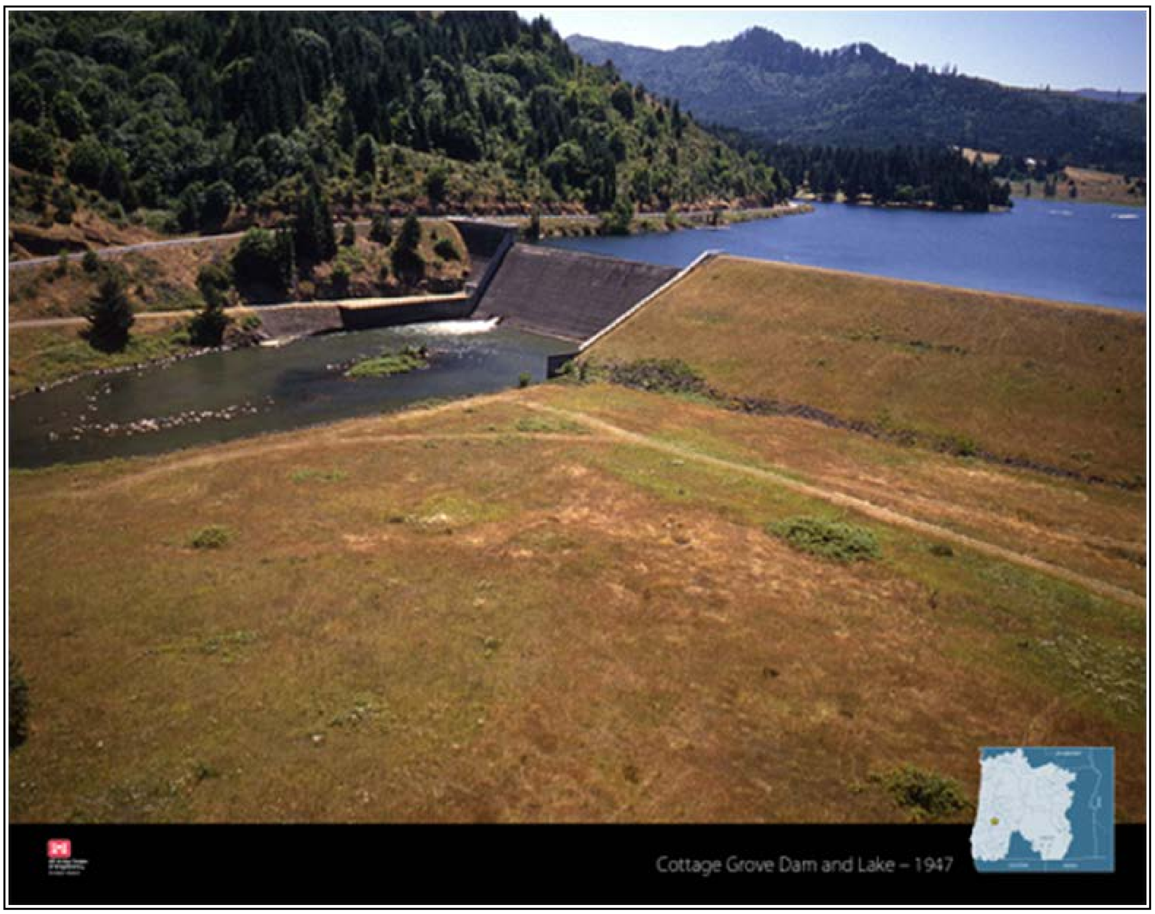
US Army Corps of Engineers
Portland District

Coast Fork Willamette River, Oregon
Surplus Water
Letter Report



December 18, 2013
Final Draft Surplus Water Letter Report

EXECUTIVE SUMMARY

The City of Creswell (City), a small bedroom community in Lane County, Oregon, has expressed an interest in purchasing surplus storage for water supply to support municipal and industrial needs from the U.S. Army Corps of Engineers (Corps). The City requested water from Dorena and Cottage Grove Reservoirs, both of which are operated as part of the Willamette Valley Project, a system of 11 dams and reservoirs and 2 reregulating dams located in the Willamette River Basin, Oregon.

To meet the immediate needs of the City of Creswell, the Corps initiated a general investigation study in the Coast Fork Willamette River sub-basin. The Oregon Water Resources Department acted as the non-federal, cost-share sponsor for this study. The purpose of the study was to identify whether a quantity of joint-use storage, up to 437 acre-feet, is available as surplus for municipal and industrial (M&I) use. A major outcome of the study was determining the price charged to municipal and industrial entities for Willamette Valley Project storage space.

This report, titled *Coast Fork Willamette River, Oregon Surplus Water Letter Report,* outlines the study purpose and authority, including a description of the study's relationship to the *Willamette Basin Review Feasibility Study*, which was placed on hold in 2000 to allow for Endangered Species Act consultation among federal agencies.

The City of Creswell's water supply needs and potential alternatives are also discussed in this report. Of those alternatives, using surplus conservation storage from the Willamette Valley Project, specifically Dorena and Cottage Grove Reservoirs, is the most efficient water supply alternative for meeting the City of Creswell's immediate water needs.

The Willamette River Basin was modeled using the Hydrologic Engineering Center (HEC) Reservoir System Simulation Program (ResSim) to assess the individual project and system effects of the proposed action. The authorized project purposes of the Willamette Valley Project, including impacts from the proposed action, were examined as part of the study and are detailed in this report. The small amount of water released from the project reservoirs is not expected to measurably impact the authorized purposes, namely flood damage reduction, navigation/flow augmentation, hydropower, fish and wildlife, water quality, irrigation, municipal and industrial water supply, and recreation. Other considerations, such as the financial feasibility of purchasing storage, environmental aspects, and dam safety considerations were also examined as part of this study.

The ResSim Program was also used to analyze the system-wide impacts of using stored water from all eleven Willamette storage projects to meet projected M&I basin-wide demands in the future. The results from this analysis were used in the cost analysis to determine the price structure for reallocated and surplus storage in the Willamette Project. A discussion of the modeling results and the calculations to determine user costs are detailed in the appendices.

The report closes with steps needed for implementation, findings of the study, and recommendations from the District Engineer.

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ACRONYMS, ABBREVIATIONS AND GLOSSARY

aMW	average megawatt
BA	Biological Assessment
BiOp	Biological Opinion
BPA	Bonneville Power Administration
cfs	cubic feet (foot) per second
Corps	U.S. Army Corps of Engineers
CWA	Clean Water Act
ESA	Endangered Species Act
FY	fiscal year
HYDSIM	Hydro Simulation (model)
IRRM	interim risk reduction measures
MAF	Million acre-feet
M&I	municipal and industrial
MSL	mean sea level
MW	megawatt(s)
MWh	megawatt hour
NMFS	National Marine Fisheries Service
O&M	operation and maintenance
ODEQ	Oregon Department of Environmental Quality
ODFW	Oregon Department of Fish and Wildlife
OWRD	Oregon Water Resources Department
PDT	Product Delivery Team
PNCA	Pacific Northwest Coordination Agreement (established in 1996)
POR	Period of Record
PVA	Power Value Analysis
ResSim	Reservoir System Simulation (model)
RR&R	Repair, Rehabilitation, and Replacement
WBR	Willamette Basin Review
WCP	Willamette Conservation Plan
WVP	Willamette Valley Project

LIST OF FIGURES AND TABLES

1 INTRODUCTION

1.1 STUDY PURPOSE

The purpose of the Coast Fork Willamette River Subbasin Surplus Water Supply, Letter Report is to identify whether there is a quantity of joint-use storage available in the Coast Fork Willamette River Subbasin projects that the Secretary of the Army can provide as surplus water to the City of Creswell for municipal and industrial (M&I) use. The State of Oregon has identified the federal reservoirs in the Willamette Valley Project as the preferred source of new water supply for growing communities and industries. The storage space would be purchased by the City of Creswell (City) for immediate consumption.

1.2 STUDY AUTHORITY

Surplus water is classified as 1) water stored in a Department of the Army reservoir which is not required because the authorized need for the water never developed or the need is reduced by changes which have occurred since authorization or construction or 2) water that would be more beneficially used as municipal and industrial water than for the authorized purpose and which, when withdrawn, would not significantly affect authorized purposes over some specified time period. The authority to sell surplus water for M&I purposes was granted to the U.S. Army Corps of Engineers (Corps) by Section 6 of the Flood Control Act of 1944 (Public Law 78-534), as amended. Under this authority, the Secretary of the Army is authorized to make agreements to sell surplus water to states, municipalities, private concerns, or individuals, at such prices and on such terms as deemed reasonable.

1.3 STUDY BACKGROUND

The Willamette Basin Review Feasibility Study was initiated in May 1996 between the U.S. Army Corps of Engineers, Portland District, and the Oregon Water Resources Department (OWRD). The purpose of the study was to analyze current water uses in the basin, to project water needs for some of the authorized purposes, and to identify reservoir water allocation options to assure the most public benefit within the policies and regulations of the Corps. Five specific goals were established for the study:

- Authorize a full range of beneficial uses (including anadromous fishery and water quality needs, municipal and industrial water supply, and recreation).
- Develop an operational agreement for low flow years.
- Determine appropriate institutional arrangements.
- Investigate modifications to water control diagrams and reduce downstream erosion during reservoir drawdown.
- Address municipal and industrial water demands and constraints.

In March 1999, steelhead and spring Chinook salmon in the upper Willamette Basin were listed as threatened under the Endangered Species Act (ESA). It was anticipated that the recommendations in the resulting biological opinion (BiOp) would include the use of stored water to meet flow requirements in the mainstem and tributary systems. The Corps and OWRD agreed to suspend the feasibility study pending resolution of the ESA consultation and issuance of a BiOp. The *Endangered Species Act Section 7(a)(2) Consultation Biological Opinion and Magnuson-Stevens Fishery Conservation and Management*

Act Essential Fish Habitat Consultation for the Willamette River Basin Flood Control Project (NMFS BiOp) and *Endangered Species Act Section 7 Consultation Biological Opinion on the Continued Operation and Maintenance of the Willamette River Basin Project and Effects to Oregon Chub, Bull Trout, and Bull Trout Critical Habitat Designated Under the Endangered Species Act* (USFWS BiOp), cumulatively referred to as Willamette BiOps, were issued in July 2008 with flow requirements for fish and a requirement to further study what are the most beneficial flow requirements for fisheries.

The Corps and OWRD have re-initiated the Willamette Basin Review Feasibility Study with a limited amount of funding. Completing this Surplus Letter Report allows the Corps to develop a system pricing methodology that may be applied to the full scale Basin Review Study and meet an immediate need for municipal water supply. The City of Creswell has identified an immediate need for an additional source of water supply and therefore cannot wait for completion of the feasibility study, which is currently pending funding to restart. Upon completion of the feasibility study, the City would then pursue permanent storage to meet their supply needs.

2 PROJECT BACKGROUND

2.1 PROJECTS AUTHORIZATION

The Corps operates a system of 13 dams and reservoirs in Oregon's Willamette River Basin, shown in Figure 2-1. These dams and reservoirs provide many benefits to the region and Nation. The Willamette Valley Project was authorized by the Flood Control Acts of 1938 (Public Law 75-761), 1950 (Public Law 81-516), and 1960 (Public Law 86-645). The 1938 Act led to the construction of Fern Ridge dam on the Long Tom River, Dorena dam on the Row River, Cottage Grove dam on the Coast Fork Willamette River, Detroit dam on the North Santiam River and Lookout Point dam on the Middle Fork Willamette River. The 1950 Act expanded the Willamette Valley Project (WVP) both in the number of projects and scope. The 1950 Act reauthorized the earlier dams, including Green Peter dam on the South Santiam River, that had not been started, and added the following dams: Big Cliff dam on the North Santiam River, Cougar and Blue River dams on the McKenzie River, Hills Creek and Dexter dams on the Middle Fork Willamette River, and Fall Creek dam on Fall Creek. The Water Resources Development Act of 1990 also added environmental protection as a primary purpose at all Corps water resource projects.

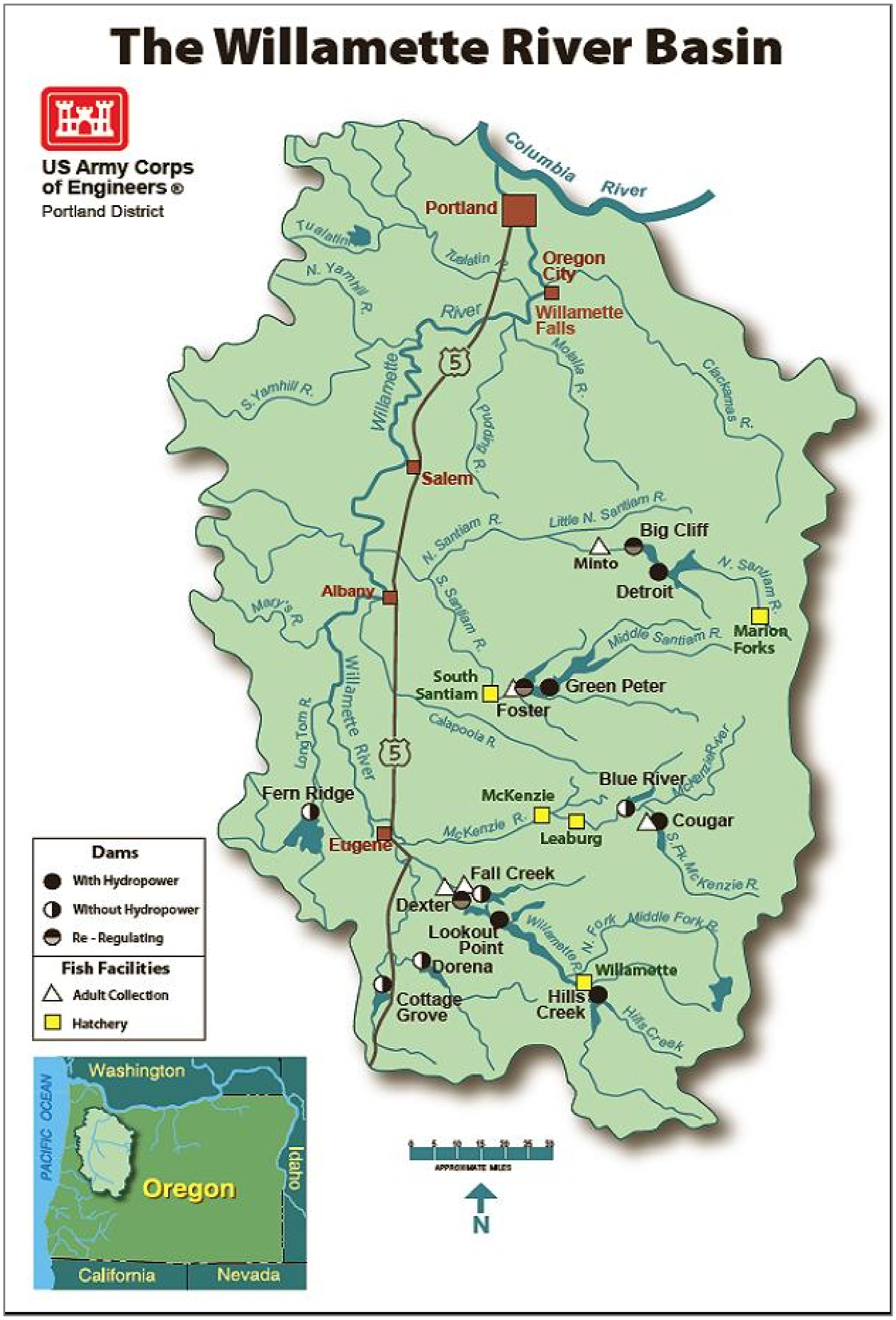
The Flood Control Act of 1950 reauthorized the Willamette Valley Project through House Document 531 (HD 531), an 8-volume authorization of the Federal Columbia River Flood Control System that encompassed the entire Columbia River Basin, including the Willamette River Basin, and established a basin-wide flood control and multi-purpose water development and management plan for the Columbia River Basin. The Willamette Valley Project, as listed in HD 531, page 246, paragraph 527, was authorized for the primary purpose of controlling floods and as a solution to major drainage problems. Secondarily, after the flood season, stored water was intended to be released for navigation, generation of hydroelectric power, irrigation, water supply, and reduction of stream pollution for health, fish conservation, and public recreation.

The dams were built from 1941 to 1969. Today, the Willamette Valley Project provides important benefits of flood damage reduction, recreational navigation, hydropower, irrigation, flow augmentation for pollution abatement and improved fishery conditions, and reservoir based recreation. Conservation storage in the reservoirs was not allocated to any specific authorized purpose, but was instead left as general, joint use, conservation storage. The U.S. Bureau of Reclamation (Reclamation), the federal agency authorized to issue stored water contracts for irrigation, filed applications for water rights in 1954 and 1968 on behalf of the federal government. Subsequent state water right certificates have been issued to authorize the storage of more than 1.6 million acre-feet for irrigation uses only. Less than five percent of the total storage is currently under contract for irrigation. Recreational use at many of the reservoirs is significant. Releases of water from the reservoirs provide instream benefits for fish, wildlife, recreational navigation and water quality.

2.2 WILLAMETTE SYSTEM RESERVOIR OPERATION

The dams and reservoirs of the Willamette Valley Project are located on 5 tributary basins and operated as a system to meet mainstem flow targets. As recognized in the authorizing documents for the Willamette Valley Project, the annual weather patterns in the Pacific Northwest and the runoff characteristics of the Willamette Basin allow the system to be operated to balance the range of authorized purposes. The well-defined limits of the flood season and planned use of storage space after the flood season allow for the impoundment of spring runoff. Starting in February, the reservoirs may begin storing water as guided by their water control diagram. From mid-April until the end of November, stored water is retained in the conservation pool for recreation and released downstream to meet other authorized purposes. Following Labor Day, water is released from the reservoirs to bring them back down to their minimum flood damage reduction pool elevations to accommodate storage for the winter flood season.

Figure 2-1. Map of the Willamette Basin



As noted earlier, seasonal regulation of each Willamette reservoir is guided by the water control diagram for each reservoir. The water control diagrams for Cottage Grove and Dorena reservoirs are shown in Figures 2-3 and 2-4. A function of the water control diagram is to show how much storage space a reservoir should reserve for flood damage reduction at any given time of the year. There are three defined reservoir control periods in a year: flood damage reduction (winter), conservation storage (spring), and conservation holding and release (summer). The dates of these seasons vary slightly by reservoir. The Corps has a high degree of operational flexibility among the 13 projects in determining how to meet the authorized purposes. Even though water may be withdrawn directly downstream of a specific project, it is necessary to coordinate releases elsewhere in the system to meet minimum flow requirements at Albany and Salem.

Figure 2-2. Map of the Coast Fork Willamette Basin

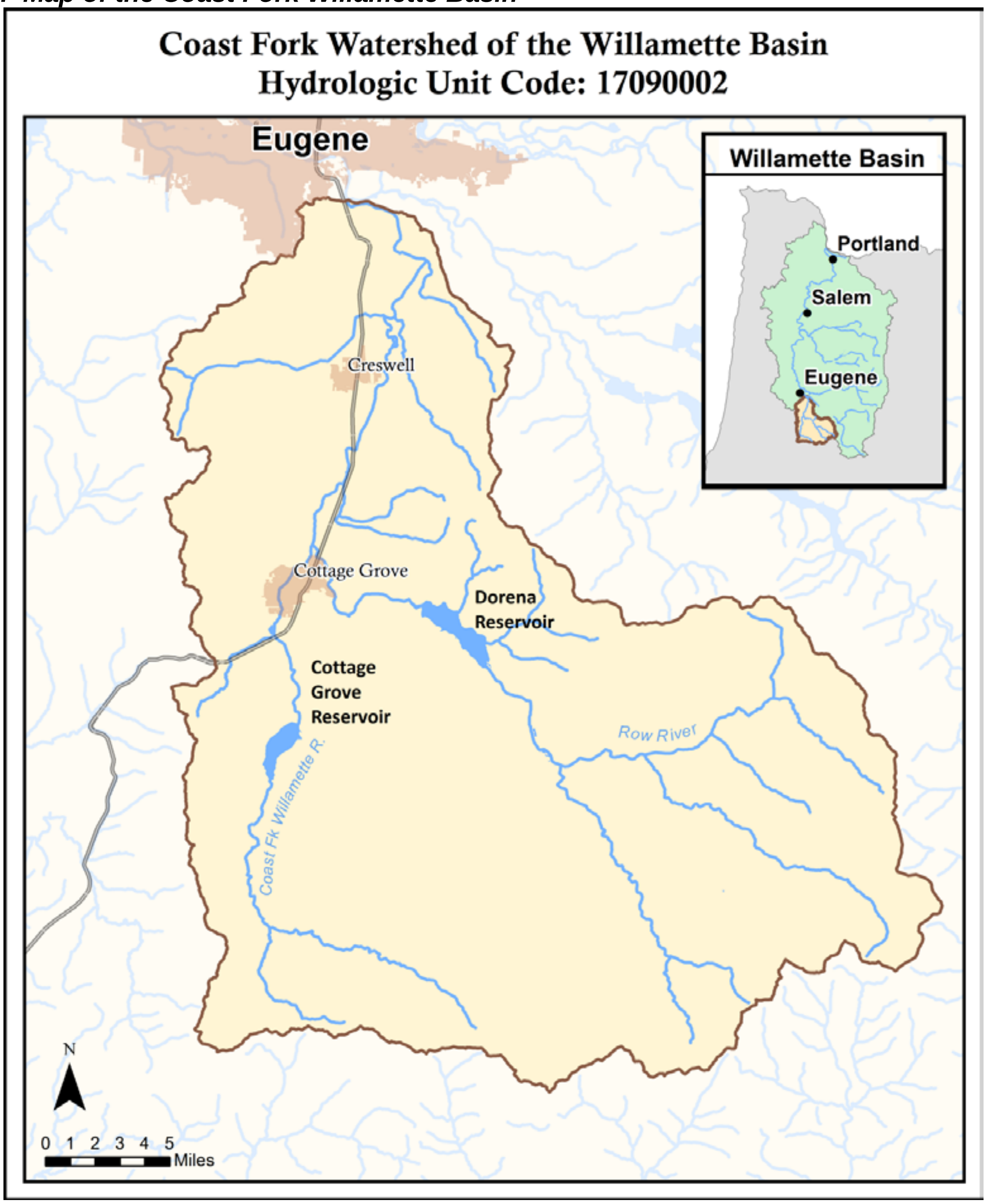


Figure 2-3. Cottage Grove Multi-Purpose Water Control Diagram

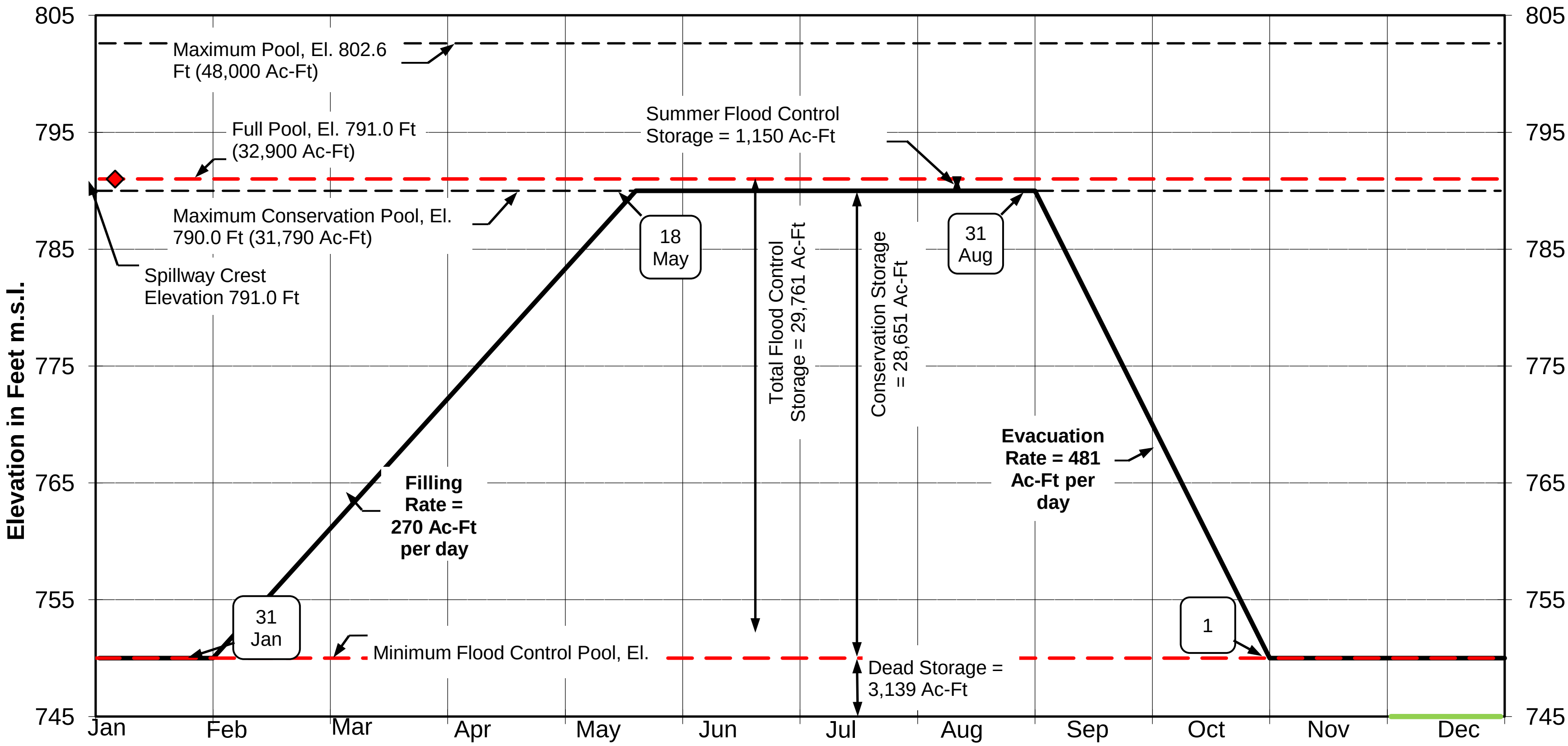
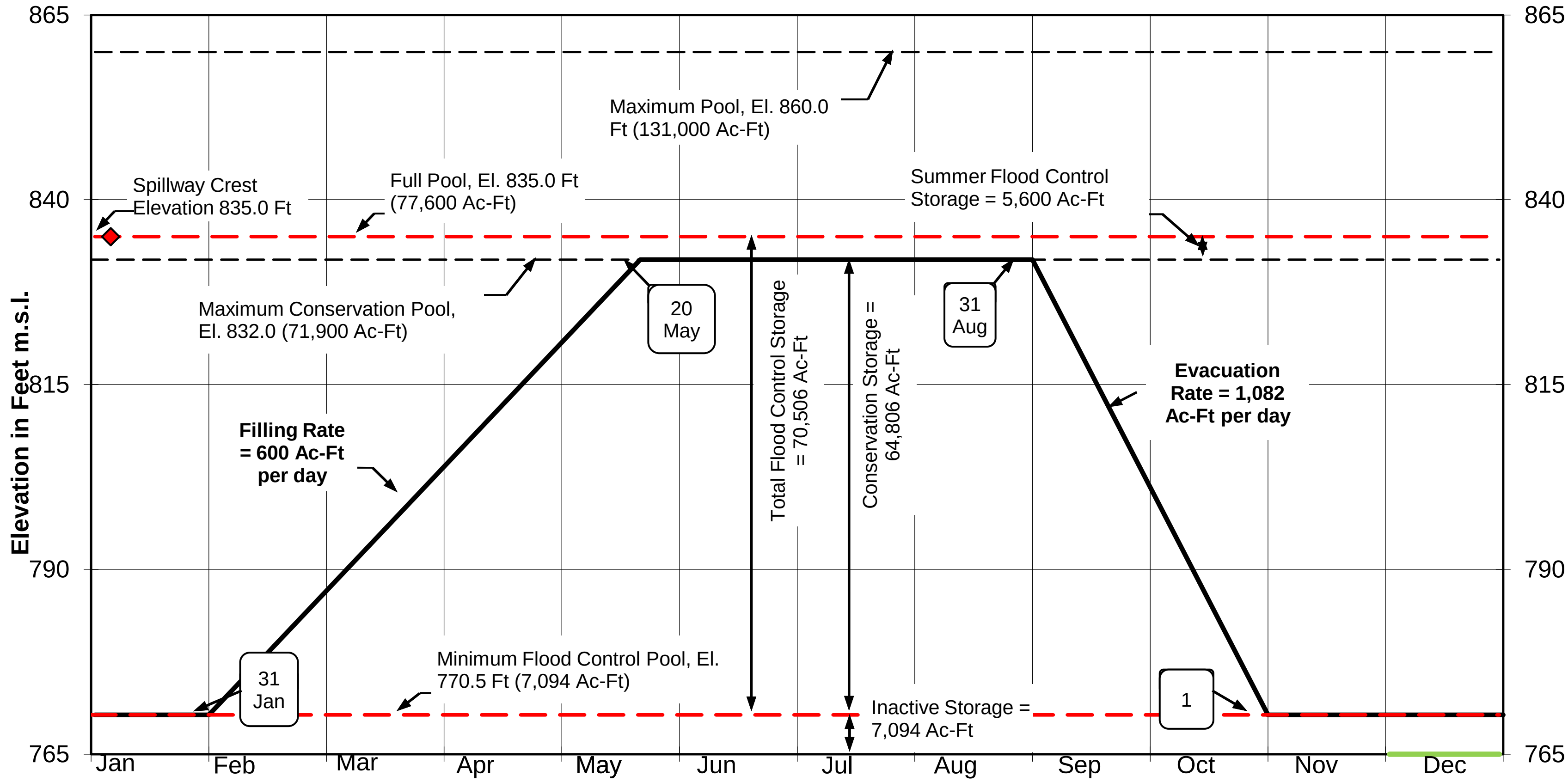


Figure 2-4. Dorena Multi-purpose Water Control Diagram



2.3 COAST FORK WILLAMETTE SUBBASIN

The focus of this letter report is on the Corps' projects in the Coast Fork Willamette subbasin. The City of Creswell requested the storage to support municipal purposes. The City is situated near river mile (RM) 13 of the Coast Fork Willamette River, downstream of the confluence with the Row River.

The Coast Fork Willamette River watershed has a drainage area of 669 square miles, or about 6% of the entire Willamette River Basin. The mainstem of the Coast Fork is impounded by Cottage Grove Dam at river mile 29.7. Dorena Dam is located at River Mile 7.5 on the Row River, which flows into the Coast Fork at RM 21. The drainage basins above Cottage Grove and Dorena Dams consist largely of steep, rugged mountainous terrain dissected by narrow river valleys.

2.3.1 Reservoir Descriptions

Completed in 1942, Cottage Grove dam is a small multi-purpose storage project on the Coast Fork of the Willamette River (Upper Coast Fork Willamette River HUC 1709000203) in Lane County. The dam has no powerhouse. The earthfill dam has a concrete spillway and the reservoir is popular for water-related recreation during the summer months. The conservation pool is 28,910 acre-feet. Pertinent project information is shown in Table 2-1.

Table 2-1. Cottage Grove Dam and Reservoir Pertinent Information

Date Completed	1942
River Mile/Stream	29.7 Coast Fork Willamette River
Drainage Area (square miles)	104
Dam Height (feet)	95
Dam Crest (elevation feet MSL)	808.0
Maximum Pool	802.6 feet (48,000 acre-feet)
Full Pool/Spillway Crest, Uncontrolled	791.0 feet (32,900 acre-feet)
Maximum Conservation Pool	790.0 feet (31,790 acre-feet)
Minimum Conservation Pool	750.0 feet (3,139 acre-feet)
Spillway	Uncontrolled concrete gravity, ogee (40,800 cfs hydraulic capacity)
Regulating Outlets	Three (3,860 cfs combined hydraulic capacity)

Cottage Grove Water Control Manual. Elevations listed in mean sea level.

Completed in 1949, Dorena dam is a multi-purpose storage project on the Row River (Row River HUC 1709000202), also located in Lane County. The dam is earthfill with a concrete spillway. The dam controls the Row River and reduces flooding downstream on the Willamette River. Like Cottage Grove Lake, Dorena Lake is popular for water-related recreation in the summer. The conservation pool is 64,806 acre-feet. The dam was not constructed with hydropower facilities, but a private company, Dorena Hydro, LLC, began construction of a private hydropower facility in 2012, including a new penstock through the dam and powerhouse. The plant is expected to be online by the end of 2013. Pertinent project information is shown in Table 2-2.

Table 2-2. Dorena Dam and Reservoir Pertinent Information

Date Completed	1949
River Mile/Stream	7.5 Row River
Drainage Area (square miles)	265
Dam Height (feet)	145
Dam Crest (elevation feet MSL)	865.7
Maximum Pool	860.0 feet (131,000 acre-feet)
Full Pool/Spillway Crest, Uncontrolled	835.0 feet (77,600 acre-feet)
Maximum Conservation Pool	832.0 feet (71,900 acre-feet)
Minimum Conservation Pool	770.5 feet (7,094 acre-feet)
Spillway	Uncontrolled concrete gravity, ogee (97,500 cfs hydraulic capacity)
Regulating Outlets	Five (9,275 cfs combined hydraulic capacity)

Dorena Water Control Manual. Elevations listed in mean sea level.

2.4 AUTHORIZED PROJECT PURPOSES (EXISTING CONDITIONS)

2.4.1 Flood Damage Reduction

The flood season in the Willamette basin normally extends over a six month period, with 70% of the annual precipitation falling between November and April. Runoff from minor to moderate storms during this period historically resulted in overbank flows on tributaries and portions of the mainstem. When authorized, Dorena and Cottage Grove dams were expected to reduce flood damages within the Coast Fork watershed by 86%. From 2001 to 2007, the Coast Fork projects provided over one million dollars in flood damage reduction (Corps 2009).

The Coast Fork Willamette River drains an area of approximately 665 square miles. Flow rates in the Coast Fork reflect the seasonality of rainfall, with the majority of runoff occurring during the winter and spring and low flows occurring during July and August. However, headwater elevations in the Coast Fork subbasin are fairly low elevation, thus, the Coast Fork hydrograph does not exhibit a spring snowmelt runoff. Within the study area the hydrograph has been altered from natural conditions. With dam regulation, the average monthly flows from February to April about 10-20% less than what they were under natural conditions, and flows from July to October are 2 to 3 times higher (Jones 2005). Peak flows have also been reduced substantially.

The dams have substantially decreased the magnitude and frequency of extreme high flow events in the Coast Fork Willamette and Row Rivers. Additionally, the dams have decreased the magnitude of lower return period channel forming flood events (USACE 2000). The bankfull flow and regulation goal at Goshen is 12,000 cfs, though flows rarely reach this magnitude. In the Coast Fork subbasin, flows are naturally lowest in the late summer and early fall. The average daily flow of the Coast Fork Willamette near Goshen in August was less than 100 cfs prior to dam construction, which increased to about 200 cfs after dam construction. Post-dam summer flows are greater than what occurred historically because multiple-use storage is available to redistribute winter volumes for irrigation, navigation, recreation, instream flows for aquatic life, and wildlife (USACE 2000).

2.4.2 Hydropower

Neither Cottage Grove nor Dorena currently have hydropower plants. As mentioned earlier, a private hydropower project is under construction at Dorena Dam. Dorena Hydro, LLC, expects to bring the plant online in the fall of 2013. The project will use Corps determined discharges for power generation.

2.4.3 Fish and Wildlife

A number of native and non-native fish species are present in the Coast subbasin, including spring Chinook salmon, rainbow trout, cutthroat trout, bull trout, mountain whitefish, large-scale sucker, sculpins, longnose dace, leopard dace, Northern pike minnow, Oregon chub, peamouth chub, redside shiner, speckled dace, three-spine stickleback, sand roller, Pacific lamprey, Western brook lamprey, river lamprey, common carp, largemouth bass, and smallmouth bass (Hulse et al 2002).

Altered natural watershed processes, modified riparian and aquatic habitat, and limited access to historical spawning and rearing areas in the subbasin have affected the productivity, capacity, and diversity of resident cutthroat trout, bull trout, and spring Chinook populations. In addition, Oregon chub have lost habitat as backwater and off-channel areas have disappeared as a result of changes in seasonal flows associated with the construction of Corps' dams in the subbasin (NPCC 2004a). Focal species present in the Coast Fork subbasin include spring Chinook, Oregon chub, Malheur mottled sculpin, Pacific lamprey, and cutthroat trout.

The Corps' dams divide the subbasin into upper and lower portions, thereby reducing the transport and delivery of large wood and substrate to downstream reaches (NPCC 2004a). Changes in the abundance and distribution of gravels and large wood (particularly in large jams) have reduced suitable spawning areas and limited areas for adult cutthroat trout and juvenile rearing habitat for spring Chinook salmon. Relative to the lower Coast Fork subbasin, the upper subbasin above the dams have aquatic habitat that is closer to the historical baseline, with the highest proportion of functioning riparian areas, the largest amounts of large wood in the river and tributary channels, and the highest quality spawning areas (NPCC 2004a). However, the upper subbasins are generally inaccessible to anadromous fish.

In addition, the dams have changed flow regimes and water temperature patterns. The change in flow regimes has altered the availability and quality of Oregon chub habitat in backwater sloughs, floodplain ponds, and other slow-moving side-channel habitat. Compared to historical conditions, water temperatures below the dams are generally cooler in the summer and warmer in the fall and winter, which affects the upstream distribution of spring Chinook salmon adults, alters the timing of spawning, and affects the period of egg incubation (NPCC 2004a). The proposed minimum instream flows under the Willamette Biological Opinion (NMFS 2008a) can be compared with flows recommended for upstream passage, spawning, incubation, and rearing of salmonids, (USACE 1982; 2000).

In the Coast Fork subbasin, the release of warm water from Cottage Grove and Dorena reservoirs appreciably reduces the value of the lower Coast Fork and Row River for salmonid production (USACE 2000). Temperatures in excess of 26ºC have been measured downstream of the dams (Thompson et al. 1966). Warm water species are much more abundant than salmonids, indicating an unfavorable temperature regime for native species (USACE 2000).

Backwater habitats, including pool margins, side channels, and alcoves, have been reduced from historical levels in the Coast Fork subbasin (NPCC 2004a). Dykaar's investigation (2005) found that river-floodplain habitats have been substantially reduced. Declining rates were found for most geomorphic indicators (main channel migration, island development, gravel supply, and large wood) following dam construction. The main channels of the Coast Fork were found to be 6% shorter in the post-dam years. The amount of exposed gravel was down 20% and total island area was down 74% from a pre-dam average for the Coast Fork.

In the lower Coast Fork subbasin, the productivity, capacity, and diversity of cutthroat trout and spring Chinook salmon populations are limited by habitat connectivity and modifications; lack of large woody debris; poor water quality; and the partial or complete barrier to upstream fish passage (NPCC 2004a). The productivity, capacity, and diversity of Oregon chub populations in the lower and upper Coast Fork subbasin are limited by an altered hydrological cycle and the frequency and magnitude of high flows; a loss of channel complexity; a reduction in the extent and lateral connection of the floodplain; the presence of non-native predators; and degradation of aquatic habitats from past industrial actions (NPCC 2004a).

2.4.4 Irrigation

Section 8 of the Flood Control Act of 1944 gives the Secretary of the Interior authority to market water from Corps reservoirs when the Secretary of War determines that available water may be used for irrigation. Since 1953, Reclamation has administered a program to market stored water available from Dorena and Cottage Grove reservoirs for the purpose of supporting irrigation needs. Contracts are made pursuant to Federal Reclamation law; in particular §9(e) of the Act of August 4, 1939 (53 Stat. 1187), §8 of the Act of December 22, 1944 (58 Stat. 887, 891), the Flood Control Act of 1938 (52 Stat. 1222), and the Flood Control Act of 1950 (64 Stat. 170).

As of 2012, there are nine irrigation contracts for stored water in the Coast Fork Willamette River watershed for a total of 1,208 acre-feet. Dorena and Cottage Grove reservoirs are also used to help supply 34,289 acre-feet in 64 mainstem Willamette River irrigation contracts.

Table 2-6 identifies the number and quantity of stored water contracts supplied, in part or entirely from the Coast Fork reservoirs.

Table 2-6. Storage Volumes Currently under Contract for Irrigation Use Entirely or Partially Met Using the Coast Fork Projects

Reservoir Providing Water	Number of Contractors	Total Acre-feet Contracted	Total Acres Served
Dorena, Cottage Grove	7	1,101	441
Dorena	1	51	20
Cottage Grove	1	56	45
Sub-total on the Coast Fork	**9**	**1,208**	**506**
All	40	20,495	9,092
All except Santiam Basin reservoirs	20	12,093	9,290
All except Santiam Basin reservoirs & Fern Ridge	4	493	224
Total	**73**	**34,289**	**19,112**

2.4.5 Municipal and Industrial Water Supply

Domestic water supply as an authorized purpose is discussed on pages 1735-1736 of HD 531, Volume 5. Paragraph 198, page 1736 states:

> "The total quantity of water required for domestic use would be small in comparison with the total storage capacity of reservoirs proposed for flood-control and other multiple-purposes uses. Ample storage in individual reservoirs, therefore, would be available at relatively low cost for domestic use when current facilities can no longer meet the demand."

To date, there are no agreements for using storage from Dorena or Cottage Grove reservoirs for M&I water supply, but there is significant interest in doing so.

2.4.6 Navigation

House Document 531 outlined flow objectives for downstream control points at Albany and Salem as well as minimum releases from the projects from June through October. These Congressionally authorized flow objectives during the conservation season were originally developed to maintain navigation depth on the mainstem Willamette River. The commercial navigation mission never materialized upstream of Willamette Falls, located near Oregon City. The flows originally authorized for the navigation mission are currently satisfying fish and wildlife and water quality missions. The minimum releases out of Dorena Dam are 190 cfs February – June and 100 cfs July – November. Cottage Grove minimum releases are 75 cfs February – June and 50 cfs July – November.

2.4.7 Recreation

Cottage Grove Lake is popular for water-skiing and fishing and ranks 73rd out of all water bodies in the state for recreational boating according to the Oregon State Marine Board. It is also popular for lakeside camping and day use associated with waterborne recreation. The Corps of Engineers operates three day-use parks and two campgrounds at Cottage Grove Lake. Pine Meadows and Primitive Campgrounds are popular destinations on summer weekends. These facilities are used to capacity during peak summer use periods. Cottage Grove Lake has boat access available to low pool. However, some facilities such as Wilson Creek Park swimming beach are sensitive to small amounts of drawdown. All of the beaches at the lake are most usable within the upper three feet of the maximum conservation pool elevation.

Dorena Lake offers a variety of recreation activities. Dorena Lake is a popular boating lake with higher percentage of sailboats and sailboards and a smaller percentage of water skiers than Cottage Grove. Dorena Lake is ranked 58th in the state for boating use. Schwarz Campground, operated by the Corps of Engineers, is located immediately downstream of the dam. The Corps also operates two day use parks along Dorena Reservoir. Baker Bay Park, operated by Lane County, includes a day-use area, boat ramp, marina, and campground. The paved Row River Trail, operated by the Bureau of Land Management, follows Dorena Lake's north shore and can be used for biking, hiking, and horseback riding.

Baker Bay and Schwarz campgrounds are highly used during the summer recreation season. However, the camping opportunities are not as closely related to waterborne recreation as at Cottage Grove. Dorena is less sensitive to minor drawdown than Cottage Grove because of its steeper shoreline. Drawdowns of a few feet do no not significantly reduce the surface area available for boating.

2.4.8 Water Quality

The Coast Fork Willamette River is water quality limited for pH, dissolved oxygen saturation (DO), nutrients, temperature, and aquatic life uses (Jones 2005). The Cottage Grove Sewage Treatment Plant is a known source, in addition to impounded water in Cottage Grove reservoir. Total Maximum Daily Loads (TMDLs) have been established, per DEQ, to address year-round water quality concerns in the river, but particularly during the summer season when elevated concentrations of nutrients facilitate algal growth, diminishing the DO available for fish and wildlife.

Water quality characteristics that are influenced by human populations include an increase in temperature, impacting fish and aquatic organisms. Fish adapted to cold-water systems (cutthroat and bull trout) are especially sensitive to even minor increases in temperatures, especially when spawning. Fecal coliform concentrations and heavy metals can directly affect human health and some species of fish and aquatic wildlife. The bioaccumulation of mercury in fish is widely recognized as an environmental problem, increasing health risks to humans. Fish consumption advisories have been issued by the Oregon Department of Human Services for the Willamette River, including the Dorena and Cottage Grove reservoirs, advising consumers of health risks associated with consuming fish caught in the Willamette Basin (Jones 2005).

Both Cottage Grove and Dorena Dams are used to support downstream flow augmentation during the low flow period of the year. As mentioned earlier, this augmentation was originally intended to support navigation, but subsequently support the authorized purposes of fish and wildlife and pollution abatement. The Oregon Department of Environmental Quality (DEQ) currently issues discharge permits based on calculated 7Q10 flows at Albany and Salem on the mainstem Willamette River. The USACE established flows during abundant and adequate years which are typically at or above the 7Q10 flows (seven day low flow with a 10 year recurrence interval).

2.5 OREGON WATER LAW

2.5.1 The Water Code

Under Oregon law, all water is publicly owned. With some exceptions, cities, farmers, factory owners, and other water users must obtain a permit or water right from the Water Resources Department to use water from any source— whether it is underground, or from lakes or streams. Generally speaking, landowners with water flowing past, through, or under their property do not automatically have the right to use that water without a permit from the OWRD.

2.5.2 Prior Appropriation

Oregon’s water laws are based on the principle of prior appropriation. This means the first person to obtain a water right on a stream is the last to be shut off in times of low stream flows. In low-water years, the water right holder with the oldest date of priority can demand the water specified in their water right regardless of the needs of junior users. If there is a surplus beyond the needs of the senior right holder, the water right holder with the next oldest priority date can take as much as necessary to satisfy needs under their right and so on down the line until there is no surplus or until all rights are satisfied. The date of application for a permit to use water usually becomes the priority date of the right.

The prior appropriation doctrine is the basis of water law for most of the states west of the Mississippi River. In Oregon, the prior appropriation doctrine has been law since February 24, 1909, when passage of the first unified water code introduced state control over the right to use water. Before then, water users had to depend on themselves or local courts to defend their rights to water.

Generally, Oregon law does not provide a preference for one kind of use over another. If there is a conflict between users, the date of priority determines who may use the available water. If the rights in conflict have the same date of priority, then the law promotes preference for domestic use and livestock watering over all other uses.

2.5.3 Obtaining New Water Rights

In order to use stored water, an application must be filed with OWRD (ORS 537.147). Most water rights are obtained in a three-step process. The applicant first must apply to the OWRD for a permit to use water. Once a permit is granted, the applicant must construct a water system and begin using water. After water is applied, the permit holder must hire a certified water right examiner to complete a survey of water use and submit a map to OWRD with a report detailing how and where water has been applied. If water has been used according to the provisions of the permit, a water right certificate is issued after evaluation of the report findings.

Water rights are not automatically granted. Opportunities are provided for other water right holders and the public to protest the issuance of a permit. Water users can assert that a new permit may injure or interfere with their water use, and the public can claim that issuing a new permit may be detrimental to the public interest. This provides protection for both existing water users and public resources (OWRD, 2009).

In addition to obtaining a water right to use stored water, other permits from local, state, or federal agencies may be required.

2.6 CORPS OF ENGINEERS EASEMENTS AND PERMITS

Easements and any necessary permits will be required for any non-Federal entity requesting storage in the Dorena or Cottage Grove Projects. These are separate legal/regulatory instruments and are described individually below.

2.6.1 Easements

Easements are required for water pipelines and water intake structures on Corps project lands. No easement that supports a water supply agreement will be issued prior to execution of a water supply agreement by all parties (Corps of Engineers Real Estate Policy, as of 2008). All future easements will contain an explicit reference to the water agreement or water storage agreement and provide an explicit provision for termination of the easement for noncompliance with any of the terms and conditions of the water agreement.

An easement is not required for this project because the water will be withdrawn from the river downstream of the project utilizing existing infrastructure not located on Corps lands.

2.6.2 Regulatory Permits

Regulatory permits are required from the Corps for any action potentially affecting waters of the U.S., subject to federal laws and regulations including, but not limited to Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act. Regulatory permits are not expected to be required as water would be withdrawn from the river via the City's existing intake structure on the Coast Fork Willamette River.

2.6.3 Existing and Pending Agreements, Easements, and Permits

There are no existing or pending water supply related agreements at Cottage Grove or Dorena. There are three access road right-of-way easements, one transmission line right-of-way easement, and one agricultural easement at the Cottage Grove project. Dorena has two easements (one powerline crossing and one access to private property); a lease to Lane County for Baker Bay Public Park; and a license to Dorena Hydro, LLC for construction and operation of a private hydropower facility.

2.7 CURRENT WATER USE

Storage space in the Willamette Valley Project conservation pools was not allocated to each of the authorized purposes, i.e. irrigation, municipal and industrial, recreation, fish and wildlife, when the projects were first authorized. The conservation pools in each reservoir are allocated for joint-use, i.e. all the authorized purposes. During the winter months, i.e. November through January, space in the conservation pool is used for flood storage, with no stored water available for other authorized purposes. Stored water is released from the conservation pool each conservation season (May through September) to support multiple purposes, including irrigation, fish and wildlife, and water quality. The reservoirs also support high levels of recreation during the summer months when the conservation pools are full or nearly full. Currently, only 1,208 acre-feet of the 93,421 acre-feet of storage are contracted for to meet one of the authorized purposes, i.e. irrigation, which equates to approximately 1.29% of the total conservation storage in the Coast Fork Willamette River.

3 PLAN FORMULATION

3.1 NEED FOR WATER

The Willamette Basin is a surface water limited system. In 1992, the OWRD revised and adopted the Willamette Basin Program[1] (the Program), described in Oregon Administrative Rule (OAR) Chapter 690, Division 502. The Program is a set of policies, objectives, and provisions that govern the future use and control of unappropriated surface water and groundwater, and directs OWRD's permitting activities. The Program strictly limits the use of surface water during the summer months. This is largely because remaining available supplies are often insufficient for meeting existing water rights and public instream uses 80 percent of the time. The Water Resources Commission has recognized that the storage of water in the Willamette Valley Project represents a critical source of current and future water supply for meeting instream and out-of-stream needs.

The Coast Fork sub-basin, as described in the State's Willamette Basin Program, includes the Coast Fork Willamette River and tributaries above the confluence with the Middle Fork Willamette River south of Springfield. Today, entities requesting to divert surface water for municipal uses in the Coast Fork basin, below Cottage Grove and Dorena Dams, are only allowed to do so from December 1 to April 30 of each year. Surface water diversions for municipal use, located above the dams, are not allowed any time of the year. The specific language and rules that govern uses in the Coast Fork Willamette Basin are found in OAR 690-502-0070. Although surface water for municipal uses is strictly limited in the Coast Fork sub-basin, the Willamette Basin Program allows water that is legally stored to be released or used for any beneficial purpose, including municipal uses.

The Willamette Basin Program also sets forth minimum perennial streamflows for three reaches in the Coast Fork sub-basin: 1) Willamette Coast Fork or its tributaries above the Willamette Coast Fork -- Row River confluence, 15 cubic feet per second, plus waters released from storage of up to 100 cubic feet per second; 2) Row River or its tributaries above the Row River -- Willamette Coast Fork confluence, 40 cubic feet per second, plus waters released from storage of up to 150 cubic feet per second; and 3) the Willamette Coast Fork or its tributaries above the Willamette Coast Fork -- Willamette Middle Fork confluence, 40 cubic feet per second, plus waters released from storage of up to 250 cubic feet per second. These minimum flows were established to support aquatic life and minimize pollution.

3.2 WATER SUPPLY DEMAND ANALYSIS

The study area in the sections below is defined as the Coast Fork of the Willamette Basin. This area was determined based on the immediate need for the City of Creswell (City) to secure an additional source of municipal water. The study area was limited to the Coast Fork subbasin because the City is located in the Coast Fork of the Willamette subbasin and it is not feasible for the City to use stored water from reservoirs outside the Coast Fork subbasin.

3.2.1 Water Supply Demand: Existing Water Users

Currently, irrigation is the only consumptive use of stored water from the reservoirs in the Coast Fork subbasin. The Bureau of Reclamation (Reclamation) has issued a total of 9 contracts in the Coast Fork

[1] http://arcweb.sos.state.or.us/pages/rules/oars_600/oar_690/690_502.html

Subbasin for a total of 1,208 acre-feet of storage as of 2012. An additional 64 Reclamation contracts on the mainstem Willamette River for 33,081 acre-feet of storage are supported in part by releases from Dorena and Cottage Grove reservoirs.

3.2.2 Total M&I Water Demand in the Study Area

The City of Creswell is located on the Coast Fork of the Willamette River. Its supply sources and projected water demands are described in the City's 2004 Water System Master Plan (Master Plan), the November 2008 report entitled "Southern Willamette Valley Municipal Water Providers" (SWMWP, 2008), the City of Creswell Water System Analysis, April 2012 (Analysis, 2012), and the City of Creswell Community Water Profile, June 2013 (Profile, 2013). The 2008 SWMWP report, which was funded by OWRD as part of its Water Supply and Conservation Initiative, described the City's 2007 population as 4,650 and its water demand for the four-month period of June-September as approximately 127 million gallons, equivalent to 390 acre-feet. The City's current population of approximately 5,000 is projected to be 9,758 in 2025 and 11,727 in the year 2032 (Lane County Coordinated Population Forecast, June 2009).

Based on recent per capita use figures, it is projected that the City's (instantaneous) water demand in the near future (2015) could exceed 2,082 gallons per minute (gpm) (about 3 million gallons per day, or 10 acre-feet per day) (Analysis 2012 and Profile, 2013).

Year	Daily Demand	Total Season Demand
	gpm	Acre-feet
2007	723	390
2015	2,082	1,123

The community of Goshen (population 1,148) is also on the Coast Fork Willamette River, but this community is small relative to the other municipalities. The City of Creswell is the only municipal water supply entity that meets its water demand using natural flow from the Coast Fork Willamette River.

An updated irrigation demand is not currently available for the Coast Fork subbasin.

3.2.3 City of Creswell Water Supply

The City of Creswell currently obtains its water supply from groundwater and natural flow from the Coast Fork Willamette River. The City's groundwater supply is authorized under two certificated water rights, which, in combination authorize the use of 22 different wells and up to 3.16 cfs, or 1,418 gpm. The City's surface water supply is authorized under two certificated water rights, which in combination authorize the use of up to 5 cfs, or 2,243 gpm, from the Coast Fork Willamette River. Although the City's water supply authorizations add up to 8.16 cfs, or 3,661 gpm, supply constraints exist that require the City to seek alternatives.

Source	cfs	gpm	Available (gpm)	Dependable (gpm)
Groundwater (22 wells total)	3.16	1,418	375	375
Surface	5.00	2,243	2,243	897
Total	8.16	3,661	2,618	1,272

Based on information in the City's 2004 Water System Master Plan (Master Plan) and communications with the City's Public Works Director, the City's groundwater supply is constrained as follows. The City's "River Wells Well Field" (6 of the 22 authorized wells) has been placed into "reserve" and is not used due to the shallow nature of the wells, their proximity to surface water sources and potential for contamination, poor well construction, and low yield. The Emerald Valley Well Field (6 of the 22 authorized wells) has also been placed in "reserve." These wells are currently not useable for potable water supply due to low yields and levels of arsenic that exceed current Environmental Protection Agency (EPA) Drinking Water Standards. Finally, the Garden Lake Well Field (10 of the 22 authorized wells) provides a very limited source of water supply for the City. Even though this groundwater source also has high levels of naturally occurring arsenic, the wells are connected to the City's water treatment plant where surface water and groundwater can be blended to dilute arsenic concentrations below the EPA Drinking Water Standards. However, due to public concerns about the consumption of water with high arsenic levels, the City only uses the Garden Lake Well Field approximately once per week for approximately four hours. The Garden Lake Well Field wells used to pump groundwater for blending with surface water produce a total of approximately 375 gpm. Therefore, of the 1,418 gpm of groundwater authorized for use, the City's actual groundwater supply is approximately 375 gpm on a very limited basis.

The City's surface water supply of 5 cfs, or 2,243 gpm, is diverted from the Coast Fork Willamette River and treated through the City's water treatment plant, which was upgraded in 2009. The City's diversion system and treatment plant are capable of supplying the full 5 cfs of supply to meet City demand (See Claim of Beneficial Use for Transfer T-9825, OWRD).

Assuming the maximum authorized rate of surface water under the City's water rights is available (2,243 gpm) and adding the 375 gpm of groundwater that the City uses on a limited basis yields a total water supply of 2,618 gpm. This total is, however, far short of Creswell's expected 2032 demand of 3,850 gpm, as projected in the City of Creswell Water System Analysis, April 2012.

In the near future, the City may also face a water supply shortfall due to the "junior" priority date of its 3 cfs surface water right and/or due to high water use industries coming back on line. The City's surface water certificate (certificate 85427) for 3 cfs has a 1989 priority date and is junior to both a 40 cfs instream water right on the Coast Fork (certificate 59761) and a 2000 cfs instream water right on the Willamette River, below the confluence of the Coast Fork and Middle Fork Willamette River (certificate 59549). Although it is expected that the Coast Fork instream water right would be met, the Willamette River instream water right may not be met during periods of low flow (based on historical gage records from the Middle Fork and Coast Fork) and could result in curtailment of the City's 1989 water right. Under such a circumstance, the City's water use under certificate 85427 could be curtailed to only allow the use of water for domestic purposes, because the instream water right does not have priority over domestic water uses. (Domestic water use includes water use for human consumption, household purposes, and domestic animal consumption ancillary to residential use. It would not include irrigation, commercial or industrial uses of water.) As a result, during periods of very low flow, the City could be subject to curtailment by OWRD's Watermaster (which did occur in the 1990s) and have very limited access to its 3 cfs water right. Under this scenario and under current conditions, the City would have a dependable water supply of approximately 1,272 gpm – 810 gpm short of the 2015 projected demand of 2,082 gpm. If a high water use industry comes back on line the shortage could be even more severe. Therefore, the City is seeking a backup water supply to provide 1.2 MGD (3.6 acre-feet per day) during the low water season. This equates to 437 acre-feet for the period June – September.

	Daily (gpm)			**June-September (acre-feet)**		
	Available	**Demand**	**Deficit**	**Available**	**Demand**	**Deficit**
2015	1,272	2,082	810	686	1,122	437

3.3 ALTERNATIVES

When the projects were originally authorized, irrigation was thought to be the largest future user of stored water. Agriculture in the Willamette Valley has not grown at the rate foreseen in the authorizing documents. Water use and conservation in the agricultural community has also changed since the WVP was authorized. The conservation storage in the entire WVP totals 1.59 MAF. Of this total, only 72,000 ac-ft are contracted for irrigation use. In the Coast Fork Willamette River, only 1,208 acre-feet of the total 93,457 acre-feet of conservation storage are contracted for irrigation.

3.3.1 Natural Flow

New surface water rights for the use of natural flow in the Coast Fork subbasin for municipal use cannot be used to meet the City’s future demands for several reasons. First, OWRD’s administrative rules generally prohibit issuance of a new year-round municipal water right. OWRD’s basin program rules “classify” (allow use of) surface water within the Coast Fork subbasin for municipal use only from December 1 through April 30 of each year. These rules would, in most cases, prevent issuance of a new municipal use permit for use during the remainder of the year. Further, issuance of a new permit would be precluded due to a lack of available surface water. OWRD’s Water Availability Analysis shows that no water is available for new natural flow water rights from the Coast Fork Willamette River from February through November of each year. Therefore, obtaining a new natural flow water right is not a viable alternative and was eliminated from further consideration.

3.3.2 Purchase Water from Another Municipal Entity

The City could develop an interconnection with, and purchase water from, another municipal water supplier. The Eugene Water and Electric Board (EWEB) is the only municipal water supplier within close proximity to the City of Creswell that has sufficient water supply and treatment infrastructure to be able to provide water to other water suppliers. This approach is, however, expected to be cost prohibitive for Creswell. No specific studies, engineering designs, or agreements exist for providing water from EWEB to Creswell; however, a recent EWEB/City of Veneta interconnection and agreement can be used for demonstrative purposes. Based on the projected cost of the pipeline from EWEB to the City of Veneta, it is estimated that the pipeline from EWEB to Creswell would cost approximately $4.7 million. The approximately 10.5 miles of pipeline from EWEB to Veneta has an estimated cost of $10 million or approximately $952,400 per mile. Assuming the same cost per mile and a pipeline length of approximately five miles yields a total cost of approximately $4.7 million. Moreover, under the current EWEB/City of Veneta agreement, the current (2013) cost of the water supply is approximately $1.24 per thousand gallons or approximately $404 per acre-foot annual cost. This is a technically feasible alternative.

3.3.3 Groundwater

The City could potentially obtain a new municipal water right for the use of groundwater. This approach, however, also poses a number of problems. Some of the groundwater in the area has naturally high levels of iron, manganese and arsenic (Master Plan, 2004; SWMWP, 2008). In addition, the issuance of new water rights for the use of groundwater has many of the same limitations as the issuance of new surface water rights, as described above. The Willamette Basin Program administrative rules presume that groundwater in unconfined alluvium within a ¼ mile of the banks of a stream or surface water source is hydraulically connected with that surface water source, and as such, is given the same classification as the surface water source. As mentioned in Section 3.1, surface water sources are strictly limited during the summer months in the Coast Fork Basin. Additionally, OWRD can determine that groundwater use within one mile from a surface water source has the "potential for substantial interference" (PSI) with surface water. If the use of groundwater will have PSI, OWRD will apply surface water availability to determine if groundwater is available for a proposed use. As described above, surface water is not available for new natural flow rights from February through November. Due to these limitations on the use of groundwater, this is not a viable alternative and was eliminated from further consideration.

3.3.4 Conservation

The City of Creswell could, in theory, institute conservation measures sufficient to eliminate its need for additional water supply beyond what can be supplied by its existing water rights. A 2010 study of conservation measures conducted for the City of Corvallis found that employing a large suite of conservation measures to obtain the maximum water savings available would yield a conservation savings of only approximately 4 percent of its average demand, and would require a budget of over $5 million. (City of Corvallis, Water Use and Water Conservation Project, 2010). This is a viable alternative and will be carried forward for further review.

3.3.5 Surplus Water from Federal Storage

Purchasing 437 acre-feet of conservation storage within Cottage Grove and Dorena reservoirs could meet the City's projected immediate needs. The City would enter into a surplus agreement with the Corps for use of up to 437 acre-feet of storage. Water would be released from one or both of the two reservoirs from June – September to meet the City's water needs. Water would be withdrawn directly from the Coast Fork Willamette River, downstream of both dams, using the City's existing withdrawal system. This is a viable alternative and will be carried forward.

3.4 ALTERNATIVES STUDIED IN DETAIL

3.4.1 No Action Alternatives

3.4.1.1 Purchase Water from Another Entity

If the surplus agreement does not go forward, the City would need to obtain water from EWEB, as described in Section 3.3.5 above.

3.4.1.2 Conservation

The City would begin implementation of conservation measures to reduce peak season demand. These measures would be employed routinely but specifically during drought years when 3 cfs of the City's water rights would be curtailed.

3.4.2 Proposed Action – Surplus Agreement

The proposed action is a surplus agreement for 437 acre-feet of storage from the Dorena and Cottage Grove reservoirs combined, resulting in approximately 2 cfs additional water to be released from either Dorena or Cottage Grove reservoirs, or a combination of the two, for the months of June - September.

Current minimum flow requirements at Dorena vary from 100 to 190 cfs, while those from Cottage Grove vary from 50 to 75 cfs, depending on the time of year, so an additional 2 cfs release from Dorena is a small percentage increase in outflows. ResSim analysis of current operations indicates that minimum releases from Dorena were satisfied in all 73 years of the Period of Record, although Cottage Grove did not always have sufficient water to meet its minimum flow requirements. Within the Period of Record analysis, Dorena at times dropped to low elevation levels during the conservation season, but always had at least 1700 acre-feet of conservation storage remaining. The surplus agreement will state that 437 acre-feet of stored water can be supplied to Creswell with 95 percent reliability for the period of June through September, while continuing current operations within the Willamette Project.

4 IMPACTS TO AUTHORIZED PURPOSES

This section addresses the impacts to the authorized purposes of Dorena and Cottage Grove dams and reservoirs from issuing a water supply agreement to the City of Creswell for 437 acre-feet of storage from the conservation pool. While these two dams are operated as part of a system of 11 storage and 2 re-regulation reservoirs, the scope of impacts is limited to these two reservoirs and their authorized purposes. The affects described below are based on the determination that the temporary use of a combined 437 acre-feet of water from Dorena and Cottage Grove reservoirs would have an unmeasurable effect on the surface elevations and outflows of the two reservoirs (See Appendix C for modeling results). Model results from Appendix C reference use of 499 acre-feet of stored water. This volume was the original focus of the report before the volume was recalculated and refined. Because model results for the 499 allocation showed insignificant changes in project conditions, there was no need to rerun the model for 437 acre-feet.

4.1.1 Flood Damage Reduction

Flood damage reduction storage space during the conservation release season is typically provided between the maximum conservation pool and full pool in the reservoirs. The surplus water would be from within the conservation pool, not the summer flood control pool; therefore there would not be an impact to the flood storage pool or the drawdown in the fall of the conservation pool to minimum flood control pool elevations at Cottage Grove or Dorena reservoirs.

4.1.2 Navigation and Flow Augmentation

Minimum flows released from the Willamette Valley Project reservoirs during the conservation season were originally developed to maintain navigation depth on the mainstem Willamette. Although a federal navigation channel is no longer maintained upstream of Portland, Oregon, minimum flows are still maintained for pollution abatement and fishery purposes, as listed by the Willamette BiOps issued in July 2008.

Based on the modeling work completed for this project (Appendix C), the proposed action is not expected to impact the ability for the Corps to maintain minimum project releases or minimum flows at Salem and Albany during adequate and abundant water years (as defined in the 2008 NMFS BiOp). During deficit years, when the demand for M&I water would be most critical, minimum flows are not always met in the current baseline without the proposed action. However, minimum flow requirements out of Dorena are met every year of the period of record in June through September in the ResSim analysis, which covers 73 years, including 10 deficit water years. The baseline analysis models current operations, which include Dorena contributing its proportional share of the mainstem targets. Releasing an additional 2 cfs from the Coast Fork Willamette River reservoirs did not change the number of days mainstem minimum flow targets were not met compared to the baseline.

4.1.3 Hydropower

There are no federal hydropower projects at Cottage Grove or Dorena dams. The private hydropower project at Dorena, will utilize the Corps' determined discharges from the reservoir. Dorena Hydro LLC will not have any authority or right to request an increase or decrease of flow from the federal project.

Therefore, power generation will not be measurably increased or decreased as a result of the proposed action.

4.1.4 Fish and Wildlife

The additional flow needed to satisfy 437 acre-feet over the months of June through September equates to approximately 2 cfs. This would not measurably alter the minimum releases from the Willamette Valley Project and Cottage Grove and Dorena reservoirs specifically. In addition, this volume would not measurably decrease the surface water elevations of the reservoir or increase water velocities downstream of the project or in the mainstem Willamette River.

As discussed above, the physical, structural and functional conditions of the Coast Fork Willamette River subbasin are substantially changed from historical conditions. Stream channelization and loss of complexity, in addition to disconnection from the floodplain, limits the ability to provide quality habitat to fish and wildlife in the watershed. Construction of the dams disconnected the lower river reaches from the headwaters, eliminated fish passage, impairing the transport to large woody debris and other sediments that maintain channel complexity. In addition, the introduction of non-native species that out-compete and predate on native species has had impacts on the diversity and abundance of many native species. The proposed action will not impact fish and wildlife species or their habitats. The release of additional water to supply the City with surplus water for M&I purposes will be inconsequential to the existing conditions of the subbasin and there will be no change to the Corps' ability to further the fish and wildlife authority. Furthermore, supplying water to the City will not conflict with minimum flow objectives for in-stream flows, as outlined in BiOps from NMFS and USFWS.

4.1.5 Water Quality

The small amount of water released to satisfy 437 acre-feet of stored water for approximately June through September is not expected to have an impact on water quality. Based on modeling results shown in Appendix C, reservoir elevations would not noticeably change, nor would the river downstream change in stage or temperature.

During the summer months, the Coast Fork Willamette River near Goshen measures approximately 175 cfs, and the Row River below Dorena has a measured flow of approximately 100 cfs. The additional flow of 2 cfs in either of these rivers would not be enough to improve or degrade water quality parameters. Temperatures, DO concentrations, nutrients and bacteria will not appreciably increase or decrease in response to the release of surplus water. As a result, there will be no change to water quality as an authorized purpose.

4.1.6 Irrigation

In 2012, the Reclamation issued contracts in the Coast Fork Willamette subbasin totaling 1,208 acre-feet, which is less than 2% of the storage in the subbasin. At the current low level of use for water service contracts in the Coast Fork subbasin, it is not necessary for the Corps to make special operational adjustments, such as increasing flow releases, to meet contract requirements. The small increment of water requested by the City of Creswell would not affect the existing irrigation contracts or the ability to issue new irrigation contracts up to 95,000 acre-feet (including existing contracts), the amount specified in the NMFS Willamette BiOps.

4.1.7 Municipal and Industrial Water Supply

There are currently no contracts for M&I water supply in the Willamette Valley Project. Providing 437 acre-feet of storage specifically to M&I water supply should not impact existing natural flow M&I water users.

Current minimum flow requirements at Dorena vary from 100 to 190 cfs, while those from Cottage Grove vary from 50 to 75 cfs, depending on the time of year, so an additional 2 cfs release from Dorena is a small percentage increase in outflows. Within the Period of Record analysis, Dorena at times dropped to low elevation levels during the conservation season, but always had at least 1700 acre-feet of conservation storage remaining. The surplus agreement will state that 437 acre-feet of stored water can be supplied to Creswell with 95 percent reliability for the period of June through September, while continuing current operations within the Willamette Project.

The state of Oregon prioritizes water for life, health, and safety over minimum flows for fish. This priority would result in modified operations during dry years to ensure adequate storage is maintained through September to meet the demand.

4.1.8 Recreation

The proposed action would not measurably decrease the elevation of the conservation pools at the Willamette Valley Project, and specifically Cottage Grove and Dorena reservoirs; therefore recreation would not be affected.

5 SUMMARY OF DERIVATION OF USER COST

The cost for surplus water from Corps of Engineers' reservoirs is calculated as the highest of three costs: 1) benefits and/or revenues foregone; 2) replacement costs; and 3) updated cost for storage. This cost is for the capital investment cost only.

The methodology for determining the user cost is described in detail in Appendix A: Derivation of User Cost. Based on the cost analysis, the updated cost of storage is the highest of the three costs for the Willamette Valley Project. The updated cost of storage was calculated using the procedure outlined in the Water Supply Handbook (Corps, 1998). The cost from the midpoint of construction was updated to the beginning of FY13.

For a contract issued in FY 2014, the updated cost of storage is $2,345 per acre-foot of storage. An annual Operation and Maintenance (O&M) cost is also due every year and is based on the O&M expense for the Project in the Government fiscal year most recently ended. Costs for repair, rehabilitation, and replacement (RR&R) are charged to users as they occur. The amount of O&M and RR&R charged to the user is based on the percentage of usable storage space contracted to the user.

Annual payments for surplus M&I water are calculated based on a 30 year repayment schedule. The annual payment for the use of 437 acre-feet of storage in FY 2014 ($1,024,765) financed over a 30 year period at an interest rate of 3.125% (EGM 13-01, Federal Interest Rates for Corps of Engineers Projects for Fiscal Year 2014) is $53,131. FY12 O&M costs for the Willamette Valley Project were $16,005,378. The requested amount of storage, 437 acre-feet, is 0.027% of the usable storage, therefore the initial O&M cost would be $4,322 ($16,005,378 * 0.027%). The O&M cost charged to the City of Creswell will be recalculated each year based on the previous year's O&M cost. The agreement holder would be encouraged, but not required, to establish a fund in the event future RR&R costs occur during the agreement period.

6 OTHER CONSIDERATIONS

6.1 YIELD

Purchase of storage from a Corps reservoir requires the determination of a storage-yield relationship for the reservoir, i.e. the amount of storage needed to meet a specified withdrawal. The Corps has determined that a storage-yield relationship will not be calculated for this report because there is very low risk to the government and the City of Creswell of not meeting the requested 2cfs demand. Hydrologic and reservoir simulation modeling of the Coast Fork reservoirs demonstrates that, for the existing basin uses, there is storage available to ensure with at least 95% reliability (through the period of record) the supply requested. If the demand cannot be met, the City would curtail water use to all users except that needed for direct human consumption.

Future reallocation efforts will require the development of a system yield methodology prior to implementation.

6.2 TEST OF FINANCIAL FEASIBILITY

The purpose of the test of financial feasibility is to demonstrate that water from storage in the Federal project is the most efficient water supply alternative. The Project First Cost of the other two alternatives (purchasing water from another entity and conservation) is $4,700,000 and $5,000,000 respectively, opposed to the surplus water Project First Cost of $915,879. The table below shows the annual costs for each alternative, assuming a 30 year repayment period.

Alternative	Capital Cost (annual payment)	Annual Operations and Maintenance	Total Annual Cost
Surplus Water	$53,131	$4,322*	$57,453
EWEB pipeline	$233,067	$176,548	$409,615
Conservation	$271,857	-	$271,857

*FY13 O&M costs were not available at the time of this report. The O&M value will be updated when the agreement is sent for signature.

Therefore, using 437 acre-feet of storage is the most cost effective source of water for the City of Creswell.

6.3 ENVIRONMENTAL CONSIDERATIONS

6.3.1 National Environmental Policy Act

Because of the small magnitude of the predicted changes to discharges and water surface elevations as a result of the proposed action, the following environmental resources would not be expected to have any measurable change over the existing condition: soils, groundwater, water quality (including cold water habitat), air quality, demographics, socioeconomics, environmental justice, recreation, aesthetics, noise, cultural resources, vegetation and protected plants, fish and wildlife and protected animals. In addition, no effects to project authorized purposes are anticipated.

Supplying the City with 437 acre-feet/year of water from a combined total of 93,716 acre-feet of surplus conservation storage for M&I purposes (the Proposed Action) is categorically excluded under 33 U.S.C. §230.9(e): *all operations and maintenance grants, general plans, agreements, etc., necessary to carry out land use, development and other measures proposed in project authorization documents, project design memoranda, master plans, or reflected in the project NEPA documents.* The attached Categorical Exclusion (Appendix D) describes compliance with environmental and historical preservation laws.

6.3.2 Climate Change

The Corps recognizes the impact climate change may have on reservoir operations and in FY13, the Institute for Water Resources (IWR) funded the Corps Portland District to initiate a study incorporating potential climate change into Corps operations in the Willamette Basin. The objective of this pilot study is to be better prepared with operational strategies for flood seasons based on understanding possible climate change impacts. Funding was subsequently pulled but may be reinstated in the future.

6.3.3 Environmental Operating Principles

The USACE Civil Works environmental mission ensures that all Corps projects, facilities and associated lands meet environmental standards.

- Principle 1. Environmental Sustainability – There will be unmeasurable effects to the natural environment.
- Principle 2. Interdependence of life and the physical environment – Use of surplus water will have negligible impacts on the environment and the hydrology downstream of Dorena and Cottage Grove Reservoirs.
- Principle 3. Seek balance and synergy among human development activities and natural systems – Providing needed M&I water supply to the City of Creswell will not impact the natural system while providing a needed resource for human development.
- Principle 4. Continue to accept corporate responsibility and accountability – The surplus agreement complies with all applicable laws.
- Principle 5. Assess and mitigate cumulative impacts to the environment – A surplus agreement, assessed with other Corps projects, does not require any separable ecosystem mitigation.
- Principle 6. Build and share knowledge – Coordination with state and federal agencies resulted in an appropriate use of surplus water from Dorena and Cottage Grove Reservoirs.
- Principle 7. Respect the views of individuals and groups – Input from federal and state agencies and the public were adequately addressed and incorporated through stakeholder meetings.

The USACE Campaign Plan is intended to "guide policy decisions on how [the Corps] organizes, trains, and equips [the Corps] personnel; how [the Corps] plans, prioritizes, and allocates resources; and how [the Corps] responds to emerging requirements and challenges." This letter report and subsequent surplus water agreement with the City of Creswell furthers the Campaign Plan Goals 2a and b, 3b, and 4a and b.

- Goal 2a: Deliver integrated, sustainable, water resources solutions – A surplus agreement will provide water for the City of Creswell, whose alternative sources for additional supplies is severely limited.
- Goal 2b: Implement collaborative approaches to effectively solve water resource problems – The Corps is working with the OWRD to provide water to a municipality in need of immediate water.

- Goal 3b: Improve resilience and lifecycle investment in critical infrastructure – When executed, the agreement establishes repayment of the capital cost of the dam in addition to annual payments of a portion of the O&M costs. This repays the federal government a portion of the annual O&M cost without the need for additional O&M tasks specific to the water supply project.
- Goal 4a: Identify, develop, maintain, and strengthen technical competencies among the USACE workforce – The modeling effort for this project challenged the team members in furthering the development of an existing computer model. Model refinements will be carried forward into other projects using a similar model.
- Goal 4b: Communicate strategically and transparently – The Corps continues to meet with stakeholders and other federal, state and local agencies as this project moves forward. Transparency has been important to maintaining a good working relationship with the parties as well as obtaining needed information for this surplus letter report.

6.4 SUMMARY OF DAM SAFETY CONSIDERATIONS

Corps dams are classified through a risk assessment process into five Dam Safety Action Classifications (DSAC) which represent varying levels of safety risks. DSAC I – Very High Urgency, II – High Urgency, III - Moderate Urgency, IV – Low Urgency, V - Normal. As a result of the Dam Safety program efforts in recent years, the Corps has performed in-depth studies to obtain a better understanding of risks and conditions at its dams. In some cases, new observations were made of symptoms of potentially serious problems. In other cases, the Corps learned original design and construction methods do not meet current safety standards. DSAC ratings are reviewed during routine periodic assessments and during special studies, during which dams are more closely reviewed and assessed.

Based on a recent risk assessment performed for Cottage Grove Dam in 2012, the project was given a DSAC III classification, indicating that the project requires further engineering evaluations to determine if repairs are required. In the interests of public safety, Corps water supply policy does not allow the conservation pool to be raised at projects where dams are classified DSAC I, II or III. Therefore, only storage within the existing conservation pool may be considered for water supply purposes. A risk assessment at Dorena Dam conducted in 2008 resulted in a DSAC IV classification for this project.

Interim and long-range measures may impact the storage in the reservoir for water supply purposes, such that the amount of storage available for water supply could be reduced. Corps water supply storage agreements require non-Federal users to share the costs of remediation measures in proportion to the storage space that has been provided to each user. The City of Creswell was notified of the DSAC for each dam and the potential impacts to water supply, including the City's responsibility to share in the costs of any potential repairs that may occur during the life of the water supply agreement.

The Portland District Dam Safety Officer has reviewed this report and in light of the risk assessments and DSAC classifications, determined discharging an additional 2 cfs through the dam during the conservation season will not increase the risks to dam safety. The memo is attached in Appendix E.

7 IMPLEMENTATION

7.1 FEDERAL AND NON-FEDERAL RESPONSIBILITIES

Federal Responsibilities
The Corps, Portland District will issue a surplus water agreement for 437 acre-feet of storage in the joint-use conservation pool for water supply to the City of Creswell, valid for five years, with the option to extend for an additional five years. The five year extension will be subject to availability and recalculation of the reimbursement. Collection of the annual OMRRR charge will be conducted in conjunction with the annual capital cost.

Reclamation and the Corps will need to submit a water right application to OWRD to transfer 437 acre-feet of storage from irrigation use to M&I use on the federal storage right certificate.

Non-Federal Responsibilities
The regulation of the use of water withdrawn or released from the reallocation of storage space at Dorena and Cottage Grove reservoirs shall be the sole responsibility of the City of Creswell and the OWRD. The City of Creswell will have full responsibility to acquire, in accordance with State laws and regulations, and, if necessary, to establish or defend, any and all water rights needed for utilization of the storage provided under this agreement. The City of Creswell will be responsible for the annual payment, which includes an annual charge for O&M based on the previous FY actual O&M expenses, and any RR&R that occurs during the period of the agreement. The City will also be required to maintain an accurate record of the water withdrawn from the Project per Article 2 of the agreement. Estimates of need and records of the quantity of water actually withdrawn will be submitted to the Corps on a weekly basis.

OWRD will need to process the change of use application to issue the City of Creswell a secondary water right to use the stored water.

7.2 AGENCY COORDINATION

Stakeholder meetings have been conducted regularly to continue the on-going dialogue about the Willamette Basin Review and keep interested parties updated on related activities. Federal, state, and local governmental agencies have been invited to participate, including representatives from the Corps and OWRD, Reclamation, NOAA fisheries (NMFS), ODFW, the Oregon Department of Agriculture and Oregon Farm Bureau, and the Cities of Salem, Hillsboro, Creswell, Eugene, McMinnville, and Tualatin Valley. In addition, watershed councils, water control districts and other non-governmental entities invited to participate include the Oregon Water Utilities Council, Oregon Water Resources Congress, Oregon Association of Nurseries, Oregon Farm Bureau, Santiam Water Control District, The Nature Conservancy and WaterWatch.

The 90% draft Report is being provided for public review, including state and federal agencies. An Agency Technical Review will be completed in August 2013 in conjunction with a second District Quality Control review.

7.3 PROPOSED AGREEMENTS

The draft agreement is provided in Appendix E. Since this is the first M&I water agreement in for the Willamette Valley Project, the documents will be sent to the Assistant Secretary of the Army for Civil Works (ASA(CW)) for approval.

7.4 REAL ESTATE CONSIDERATIONS

A real estate plan and easement are not required as stored water from this reallocation would be withdrawn at the City of Creswell existing intake structure on the Coast Fork Willamette River, downstream of the two Corps dams and not on Corps lands.

8 CONCLUSIONS AND RECOMMENDATIONS

8.1 FINDINGS

The City of Creswell requested up to 437 acre-feet of storage from Dorena and Cottage Grove Reservoirs, combined. These reservoirs are part of the Willamette Valley Project, a system of 11 dams and reservoirs and 2 reregulating dams in the Willamette Valley of Oregon.

8.2 RECOMMENDATIONS OF DISTRICT ENGINEER

Based on the findings of this report and pursuant to Section 6 of the Flood Control Act of 1944, it is recommended to issue a surplus water agreement for 437 acre-feet of surplus conservation pool storage at Dorena and Cottage Grove Reservoirs, combined, to satisfy current water demands for the City of Creswell.

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APPENDIX A DERIVATION OF USER COST

A.1. VALUATION OF PROJECT AUTHORIZED PURPOSES

This section summarizes how the economic benefits were determined for the Corps' Willamette Valley Project (WVP). The purpose of this section is to determine the price charged for M&I water supply in the Willamette Valley Project. Special emphasis was placed on hydropower and recreation, since these uses of stored water and their benefits take place at the reservoir, rather than downstream of the reservoir.

The economic impacts described below are based on the full 2050 municipal and industrial demands for stored water from the WVP. The WVP is a system of eleven storage and two re-regulating dams and reservoirs operated as a system for the primary authorized purpose of flood damage reduction and to meet flow targets at Albany and Salem. Conservation storage is provided in the reservoirs during the non-flood season and stored water can be used to support the secondary authorized purposes of navigation, hydroelectric power, irrigation, water supply, pollution abatement, fish conservation, and public recreation. Economic benefits were derived for hydropower and recreation.

System-wide impacts are being assessed because the Corps will charge a system price for the storage, not the cost for the individual reservoir. System pricing was approved by the Assistant Secretary of the Army for Civil Works (ASA(CW)) for surplus agreements in 1997. Using a system price reflects the reality of operating the projects as a system and maintains operational flexibility in meeting the authorized purposes.

A.1.1. Base Condition

The base condition incorporates continued operation and management of the hydropower and recreation resources of the Willamette projects and their downstream reaches as currently practiced, whether it is by Federal, State, or County resource management agency.

No new federal hydropower projects are expected to be constructed at any of the Willamette Valley projects. Dorena Hydro LLC is constructing a hydropower facility at Dorena Dam. The project will have a total capacity of 8 mW (but an operational maximum of 5 mW) and is expected to be online by the end of 2013.

No major recreation improvements are planned by the Corps at the dam and reservoir projects. Small work items planned include upgrading items to meet universal accessible standards: new bicycle and hiking trails, fish and wildlife habitat work; new road surfaces; erosion control; landscaping; weed control; new signs, fences, gates; and other maintenance items. These changes are anticipated to increase visitation by less than 5 percent in the foreseeable future. Lane County, Linn County, Oregon State parks, and the US Forest Service also will continue to maintain their respective recreation areas associated with the Corps lakes.

Lane County anticipates some recreation improvements at Dorena, Fern Ridge and Fall Creek projects. Plans at Baker Bay Park at Dorena Lake include enlarging the marina, developing a group picnic area, and a 25 unit campground. For Richardson Park at Fern Ridge Lake, a group picnic area, 40 more camping spaces, and a wetland interpretative center are planned. Redevelopment of the day use area at Zumwalt Park is also planned. At Winberry Park on Fall Creek Lake, a group picnic area and a 40 unit campground are planned. Linn County may expand some campgrounds at Green Peter and Foster lakes.

Facility improvements are planned by Oregon State Parks at Champoeg State Heritage Area, Spring Valley Access, Willamette Mission State Park, Browers Rocks State Park, and Marshall Island Access all on the mainstem Willamette River. Some minor improvements are also planned at Detroit Lake State Recreation Area on the North Santiam River, and at Pengra Access on the Middle Fork Willamette River.

The type of recreation activities pursued at the Willamette dams and reservoir projects is anticipated to remain similar to the existing mix of activities. It is expected that increases in the amount of recreation use will remain a function of summer weather conditions and population in the basin. Prolonged periods of hot, dry summer weather or prolonged periods of unsuitable summer weather conditions could be expected to affect recreation use of the Willamette Lakes by 10 percent or so. Also, those lakes located closest to the basin's population centers can be expected to remain the most heavily used for recreation activities.

A.1.2. Hydropower

The Hydropower Analysis Center (HAC) determined the hydropower benefits and economic analysis associated with reallocating the full (2050) projected municipal and industrial demand of 207,828 acre-feet for stored water in the Willamette Valley. The full analysis is detailed in Appendix B. Hydropower Analysis.

Analysis of hydropower impacts due to reallocation of reservoir storage and operation of the system of USACE hydropower projects in the Willamette River Basin to meet water supply requirements included the computation of the following values:

- power benefits foregone
- replacement cost (assumed to be the same as benefits foregone)
- revenues foregone
- credit to the Federal power marketing agency
- power generation emissions avoided

In consultation with BPA Staff, the hydropower impact of reservoir storage reallocation for meeting all M&I requirements in the Willamette River Basin through 2050 was based on the computed benefits foregone. Revenue foregone and cost of replacement power was assumed to be equal to benefits foregone and no credits will be considered because the magnitude of the impact to hydropower generation of the Willamette River Basin projects is insignificant.

A.1.3. Recreation

Water based recreation and water quality improvements exhibit benefits of a public or collective nature, in that once they are provided, consumers cannot readily be excluded from using them. Demands by recreationists for amply filled reservoirs are increasingly competitive with flood management, releases for instream flows for water quality, fish and wildlife, navigation, downstream recreation, crop irrigation and other uses. Thus, recreational values of water are useful in assessing tradeoffs in reservoir management. Although research indicates there are a multitude of means to value water related public goods, such as recreation, the Corps recognizes three techniques for valuing recreation benefits.

The basis for recreation valuation associated with water and related land resource planning includes an estimate for NED benefits that includes 1) estimating the value of the projected recreational use that would occur with the plan and also that would be diminished by the plan; 2) taking into explicit account the competition from other recreational opportunities within the area of influence of the proposed plan; 3) estimating future recreational use and value, on the basis of socio-economic variables over the entire life of the project under both the with and without project conditions; 4) calculating benefits as the difference between the with-plan and without-plan value of recreational opportunities within the market of the project.

Unit day, travel cost, and contingent value are three methods to estimate recreational demand and value and have been applied to a variety of recreational goods. These techniques are described in ER1105-2-100 (Planning Guidance (P&G) Notebook) and are the basis for estimating the NED net benefits.

Both the travel cost and contingent value methods determine the value of a recreational site by attempting to approximate the price-quantity demanded relationship. This means they can simultaneously estimate use as well as the willingness to pay for that use. Unit Day Values apply a price to an expected visitation use of a project.

A.1.4. Water Quality Improvements

Estimating the economic benefits of water quality improvement is among the most frequently encountered but most difficult tasks of water valuation. Benefits may be received by both users and nonusers. Users can be offstream producers, offstream consumers, and public good beneficiaries, such as recreational water users, municipal and industrial users, and agriculture interests.

Due to the compatibility of increasing downstream flows for M&I purposes and the potential reduction of environmental damages resulting from concentrated pollutants (dilution), which depends on distance and time from the point of discharge, temperature, rates of flow, and the quality of the receiving waters, no models will be presented within this report to forecast the effects of changes in discharges on downstream pollutant concentrations. Furthermore, due to the public nature of water quality, and the difficulty of assigning a value for water quality improvements or declines, no further analysis was conducted.

A.1.5. Navigation

Very little inland navigation exists within the Willamette River Basin, causing very little conflict between water released for water borne transportation purposes and for competing purposes such as hydropower, recreation, and flood risk management; therefore no further analysis was conducted or considered when determining the system price for storage.

A.1.6. Flood Risk Management

Reallocation of storage will not affect flood damage reduction operations; therefore no further discussion is required.

A.1.7. Irrigation

The U.S. Bureau of Reclamation administers the water service contracts for irrigators using conservation storage from the Willamette projects. The cost per acre-foot of this storage is based on the original cost of the projects with no escalation of original costs to current price levels or interest, plus an administrative fee. The Bureau charges a minimum charge which is the greater of $2 per acre of irrigated land or $50, and once the minimum is met, a rate of $8 per acre-ft. Because the volume of water required for irrigation, and its associated reservoir storage, does not change when comparing the “with and without project conditions," no valuation for irrigation is presented within this analysis when determining the benefits and revenues foregone.

A.1.8. Fish and Wildlife

In many environmental evaluation problems, such as valuing improved conditions for threatened and endangered species within the Willamette River, economic value measures cannot be derived from individual market decisions. Some goods and services provided by public policy or the environment contribute to satisfying consumer preferences but are unable to be valued via market transactions. When a policy is potential rather than actual, or when nonuse (or passive use) values are involved, market transactions are difficult to identify.

Unlike *revealed preference* methods, which require some sort of natural market experiment to provide data (such as the travel cost method for recreation), citizens of the community can be questioned directly for preferences regarding proposed environmental policy (*expressed preference*). A sample of respondents are presented a description of conditions simulating a hypothetical market in which they are asked to express their willingness to pay (WTP) for existing or potential environmental conditions not observed in the market place. The most common form of questioning to ascertain individual valuations of hypothetical future events is called the Contingent Valuation Method (CVM).

The general approach is well documented in the P&G Notebook and the available NED manuals. No known studies have been found to document the tradeoffs between allocating water for fish habitat restoration purposes and municipal and industrial water storage within the Willamette Basin reservoirs. Due to the public nature of protecting endangered species, no value estimate will be derived for improved conditions for threatened and endangered species within the Willamette River, as economic value measures cannot be derived from individual market decisions. Baseline hydraulic models included releases for fish purposes; therefore changes from the baseline for M&I purposes also included water volumes for fish flows.

A.2. DERIVATION OF USER COST

A.2.1. Benefits/Revenues Foregone

A.2.1.1. Recreation

The Willamette Basin reservoirs do not contain specialized recreation activities; rather all reservoirs within the system contain general recreation activities, such as water skiing, fishing, nature photography, picnicking, boating, and camping, among other general recreational activities that involve relatively easy access to recreation facilities. Recreational benefits foregone were calculated using the Unit Day Values method, using the highest unit day value as provided in the Economic Guidance Memorandum, 13-03, titled Unit Day Values for Recreation for Fiscal Year 2013 ($ 11.39) for the economic evaluation purposes. An estimate of total recreation days for General Recreation was derived using visitation data from OMBIL and VERS database employing 2012 data for the period May 1st through August 31st, which amounted to 1,539,439 total visits per year for all 11 reservoirs. Data was obtained for all day use areas and campgrounds, regardless which Federal, State or Local agency managed the recreational facility associated within the Willamette Basin reservoirs. To calculate the maximum value of the recreational benefits, $11.39 was multiplied by 1,539,439 visitors, for a total of $17,534,210 per year when all conservation pools are full and usable for recreational purposes.

For purposes of analysis it is assumed all recreational opportunities would be foregone should water within the system of reservoirs be used exclusively for Municipal and Industrial purposes. The value for annual recreational benefits foregone (dollars per year) is therefore considered to be $17,534,210.

A.2.1.2. Hydropower

Hydropower impacts were assessed by BPA and the Corps Hydropower Analysis Center and are summarized in Appendix B. The HAC determined that regulating the Willamette River Basin Projects to supply the full projected demand for M&I stored water supply does not incur any capacity losses; therefore there are no capacity benefits foregone. Because there is no capacity loss, the hydropower benefits foregone are equal to the energy foregone which is about $380,000 ($1.83 per acre foot).

A.2.1.3. Total Benefits/Revenues Foregone

The total for the average annual benefits/revenues foregone is the sum of the values calculated above for recreation and hydropower and is listed in Table A.2.1 below.

Table A.2.1 - Total Annual Benefits/Revenues Foregone

Recreation	$17,534,210
Hydropower	$380,000
Total	$17,914,210

A.2.2. Replacement Cost

None of the proposed surplus water supply is from flood control, and therefore, no replacement cost for equivalent protection is presented in the economic analysis

A.2.3. Updated Cost of Storage

The updated cost of storage for M&I water supply was determined by first computing the joint-use costs at the time of construction by subtracting the specific costs from the total construction cost and multiplying the result by the ratio of storage (ac-ft) to total usable storage space (ac-ft). In this computation, usable storage did not include space set aside for sediment distribution or for hydropower head. The cost allocated to the storage on this basis was escalated to present day price levels by use of the Corps of Engineers Civil Works Construction Cost Index System (CWCCIS). This index is maintained in EM 110-2-1304. Since the CWCCIS dates back only to 1967, the ENR Construction Cost Index was used to update the cost of older projects to the 1967 time frame. Costs were indexed from the midpoint of the physical construction period to the beginning of the fiscal year in which the project became operational. In this manner, interest during construction was not used in this updating procedure. Table A.2.3 below lists the variables used in calculating the updated cost of storage for the eleven storage projects.

The results from Table A.2.3 show the updated cost of storage ranges from $761 to $5,430. The eleven storage projects are operated as a system to meet multiple operational requirements during the conservation season and flood season, including existing irrigation contracts, fish and wildlife flows, and water quality considerations. Since the projects are operated as a system, the Corps determined a single system price is the preferred cost to charge M&I users. The system price was calculated by dividing the "Indexed FY2014 Construction Costs" ($3,933,623,762) by the "Total Usable Storage" (1,677,551) in order to derive a per-acre foot cost value that is equivalent to performing a weighted average for each reservoir based on its "Total Usable Storage." Using this system approach, the cost per acre-foot is $2,345 based on FY14 interest rates. Discounting the present value of $2,345 for the entire system, using the Federal discount rate of 3.50%, over a 50 year project life, the average annual value for the updated cost of storage is $100 per acre foot. The system price was calculated by taking the total acre feet of water required for M&I purposes (207,828 acre-ft) multiplied by the per acre-ft updated cost of storage ($2,345 see below) and then annualized using the Federal discount rate of 3.50% over a 50 year period. The calculation derives a value of $20,776,590.

A.2.4. User Cost

The price for water supply storage in the Willamette Valley Project reservoirs is established as the highest of three different economic evaluations: 1) Benefits and/or Revenues Foregone; 2) Replacement costs; and 3) updated cost for storage.

The total benefits/revenues foregone and updated cost of storage using the full 2050 M&I demand are listed in the table below. Comparing the updated cost of storage to the annual benefits/revenues foregone, the updated cost for storage exceeds the other means to calculate the cost for water storage; therefore, the cost allocated to the non-Federal sponsor (i.e., the price to be charged for the capital investment for the reallocated storage) will be established by the updated cost of storage per ER 1105-2-100, Appendix E, Section E-57, page E-216, paragraph d(2).

Table A.2.2 Economic Criteria

Economic Criteria	Value
Total Benefits/Revenues Foregone	$17,914,210
Replacement Costs	N/A
Updated Cost of Storage	$20,776,590

Table A.2.3 - Determination of Updated Cost of Storage

WILLAMETTE RIVER BASIN PROJECT - TOTAL USABLE STORAGE

COST/ACRE-FOOT ADJUSTED TO CURRENT PRICE LEVELS

Updated to FY 2014

Project	Total Storage Full Pool (Acre-feet)	Total Exempt Storage * (Acre-feet)	Total Usable Storage (Acre-feet)	Beg Const. Period	End Const. Period	Mid-point of Const.	Annual Ave. ENR Index Const. (Mid of Const.)	ENR factor to 1967 price level	Initial Const. Cost** (Joint-Use)	Updated Construction Cost to 1967 (Joint Use)	Indexed FY 2014 *** Const. Cost (Joint-Use)	Cost per acre-foot of usable storage
Blue River	89,500	3,971	85,529	May-63	Oct-68	Jan-66	1019	1.0540	$29,381,230	30,967,067	$233,098,040	$2,725
Cottage Grove	32,900	3,139	29,761	Aug-40	Sep-42	Aug-41	258	4.1628	2,276,000	9,474,512	71,317,381	2,396
Cougar	200,000	52,200	147,800	Jun-56	Nov-63	Feb-60	824	1.3034	49,262,900	64,209,168	$483,320,921	3,270
Detroit	455,100	154,400	300,700	May-47	Oct-53	Jul-50	510	2.1059	41,405,200	87,194,480	$656,337,990	2,183
Dorena	77,600	7,094	70,506	Jun-41	Nov-49	Aug-45	308	3.4870	13,306,000	46,398,195	$349,252,590	4,954
Fall Creek	123,162	9,505	113,657	May-62	Oct-65	Jan-64	936	1.1474	20,099,700	23,063,117	$173,602,733	1,527
Fern Ridge	97,300	2,802	94,498	Apr-40	Dec-41	Jan-41	258	4.1628	2,296,000	9,557,767	$71,944,071	761
Foster	60,800	31,100	29,700	Jun-61	Jun-67	May-64	936	1.1474	18,673,300	21,426,415	$161,282,801	5,430
Green Peter	428,100	159,900	268,200	Jun-61	Jun-67	May-64	936	1.1474	47,734,500	54,772,279	$412,286,734	1,537
Hills Creek	355,600	155,400	200,200	May-56	Nov-61	Jan-59	797	1.3476	39,168,300	52,781,373	$397,300,611	1,985
Lookout Point	455,800	118,800	337,000	May-47	Dec-54	Feb-51	543	1.9779	62,054,390	122,737,412	$923,879,889	2,741
Total	**2,375,862**	**698,311**	**1,677,551**						**$325,657,520**		**$3,933,623,762**	

* Dead or inactive storage + storage for hydropower head.

** Cost data obtained from original cost allocation reports for each project.

*** CWCCIS Index applied 1967 - Sept 2013.

Storage Data obtained from current (2013) rating tables.

Initial cost per acre-foot of Usable Storage **$194**

Updated (FY14) cost per acre-foot of Usable Storage **$2,345**

These values assume a system pricing methodology and are not simply an average of the individual project's per acre cost.

APPENDIX B HYDROELECTRIC POWER

B.1. INTRODUCTION

B.1.1. Purpose and Scope

This report, prepared by the Hydropower Analysis Center (HAC) for the Portland District (NWP), Corps of Engineers, presents details of the hydropower economic analysis associated with the Willamette Basin Review under which reservoir storage is to be used for the purpose of municipal and industrial (M&I) water supply. The purpose for the analysis of hydropower impacts is to support the benefit analysis to determine the price to be charged for the use of reservoir storage for municipal and industrial water supply and determine if any credits may be due to the hydropower users who may be impacted by use of the reservoir storage for M&I purposes. This report summarizes the hydropower impact of meeting the projected municipal and industrial water supply requirements for the Willamette River basin in the year 2050.

B.1.2. Project Description

The Willamette River system consists of thirteen Corps projects; Detroit & Big Cliff, Green Peter & Foster; Cougar, Blue River; Hills Creek, Lookout Point & Dexter, Fall Creek; Dorena and Cottage Grove; and Fern Ridge. The projects are multi-purpose reservoirs authorized for the primary purposes of flood control, navigation, irrigation, water supply, and hydroelectric power generation. Other authorized purposes are recreation, water quality improvement, and fish and wildlife. A map of the Willamette River Basin is shown in Figure B.1.1. Hydropower impacts were computed only for those projects that have hydropower plants.

The reservoir system is operated to maintain seasonally defined flood control storage space. Downstream river flow criteria have been established at downstream control points to achieve project benefits. The regulating discharge criteria are supplied for all stream control points (including reservoir outflow controls) as a seasonal function of a system state parameter. Runoff forecast and these criteria are used by a system model which iteratively computes reservoir discharges which balances the remaining reservoir storage without exceeding downstream control point criteria. Consequently, the use of storage at Willamette River Basin reservoirs for increased water supply demands has impacts to the system of hydropower projects.

The relevant hydropower project economic analysis parameters are shown in Table B.1.1.

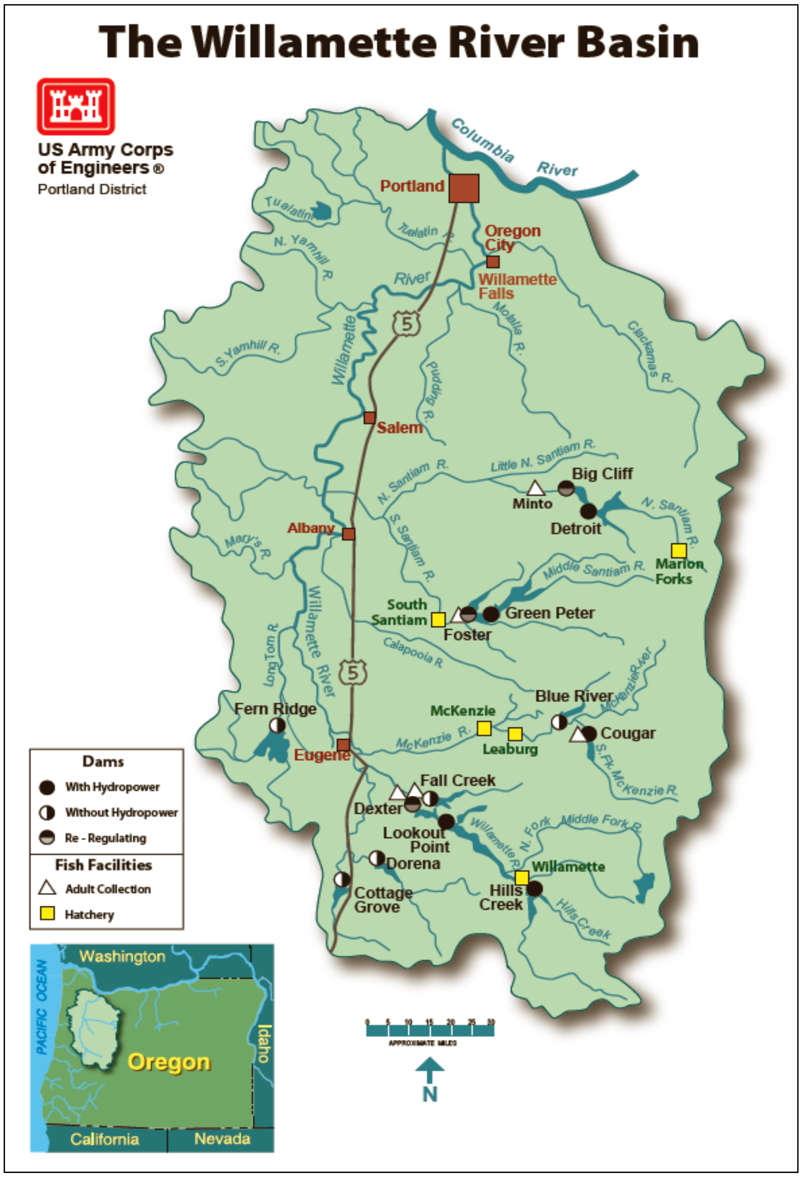

Figure B.1.1 The Willamette River System

Table B.1.1 Pertinent Study Data Hydropower and Economic Parameters

	Power		Economic Factors			
Power Project	Rated Capacity (MW)	Power-on-Line (POL)	Project Age (years) As of (15-Apr-13)	Remaining Economic Life of 50-years	Economic Analysis Period (years)	Federal Interest Rate
Big Cliff	18	12-Jun-54	59	-9	50	3.75%
Cougar	25	24-Mar-64	49	1	50	3.75%
Detroit	100	26-Jun-53	60	-10	50	3.75%
Dexter	15	19-May-55	58	-8	50	3.75%
Foster	20	22-Aug-68	45	5	50	3.75%
Green Peter	80	9-Jun-67	46	4	50	3.75%
Hills Creek	30	2-May-62	51	-1	50	3.75%
Lookout Point	120	16-Feb-55	58	-8	50	3.75%

B.1.3. Alternatives Considered

Portland District (NWP) requested the Hydropower Analysis Center (HAC) evaluate the following alternative use of reservoir storage:

Base Case – Early Implementation – This Base Case is described in Appendix C.

Meets All M&I (2050) – Water Supply Diversions indentified by the sponsor as projected requirements in the year 2050; described in Appendix C.

The difference in hydropower generation between these two alternatives represents the impact of full development of M&I water supply requirements in the Willamette Basin served by the USACE system of reservoirs over this period.

B.1.4. Assumptions

The following were assumed as part of this analysis:

- The evaluation of energy benefits foregone due to Willamette River Basin M&I water supply withdrawal requirement in 2050.
- These simulations include the Early Implementation of environmental flows.
- Water supply withdrawals are considered “consumptive use”.
- The water supply withdrawal rates and return rates are specified seasonally and listed in the hydrologic analyses in Appendix C.
- The most likely, least costly type of thermal generation plant to replace the Willamette River Basin generation is a combined-cycle (highly efficient) natural gas-fired combustion turbine generating station.
- The interest rate used is the FY13 federal interest rate of 3.75%.
- The period of analysis for this study is 50 years.
- The prices used in determining the energy and capacity unit-values are based on October 2013 price levels, which are assumed to apply over the entire period of analysis.
- Totals presented in tables may not sum due to rounding.

B.2. HYDROPOWER ANALYSIS

The price for the reservoir storage used for M&I water supply that is to be charged to the M&I water supply users must be determined, in addition to determining the economic and environmental impact on hydropower. Procedures for computing the cost of storage reallocation addressed in this study are outlined in ER 1105-2-100, *Planning Guidance Notebook* (22 April 2000), Appendix E, paragraph E-57, d(2).

Analysis of hydropower impacts due to reallocation of reservoir storage, and operation of the system of USACE hydropower projects in the Willamette River Basin to meet water supply requirements, considered computation of the following values:

- power benefits foregone
- power revenues foregone
- replacement cost of power
- credit to the Federal power marketing agency
- power generation emissions avoided

The following paragraphs briefly describe each of these values. The hydropower impact analysis will be limited to calculation of power benefits foregone and emissions avoided, for reasons explained below in Section B.2.1.

B.2.1. Power Benefits Foregone

Hydropower benefits are normally based on the cost of the most likely alternative thermal source of power. The power benefits foregone can be divided into two components, energy value and capacity value. In the case of water supply withdrawals, there is usually a loss of energy benefits, which are based on the loss in generation as a result of water being diverted from the reservoir for water supply rather than passing through the hydropower plant. The energy value is equal to the incremental cost, primarily fuel, of the alternate source that replaces the lost hydropower generation.

Loss of capacity benefits would result from a loss in dependable capacity at the project due to a loss in head due to lower post-withdrawal reservoir elevations; or a reduction in the usability of the capacity due to inadequate energy to support the full capacity during low-flow periods. The capacity value represents the capital cost, and fixed operation and maintenance costs, of the alternate energy source.

B.2.2. Revenue Foregone

The second power-related cost is the revenue foregone. Marketing of power is not performed by the Corps, but rather by the Federal power marketing agencies (PMA). The revenue foregone is the value of the lost hydropower based on the PMA's current energy rates, ER 1105-2-100, *Planning Guidance Notebook* (22 April 2000), Appendix E, paragraph E-57, d(2)(b).

B.2.3. Cost of Replacement Power

Cost of replacement power is a National Economic Development (NED) cost similar to power benefits foregone, and is therefore a redundant value in the case of hydropower. NED power benefits foregone are based on the cost of the most likely alternative, which in fact is the cost of replacement power, ER 1105-2-100, *Planning Guidance Notebook* (22 April 2000), Appendix E, paragraph E-57, d(2)(c).

B.2.4. Credit to power Marketing Agency

Project costs originally allocated to hydropower are being repaid through power revenues which are based on rates designed by the Federal power marketing agency (PMA) to recover allocated costs. ER 1105-2-100 (22 April 2002), *Planning Guidance Notebook,* Appendix E-57d(3) states that: "If hydropower revenues are being reduced as a result of the reallocation, the power marketing agency will be credited for the amount of revenues to the Treasury foregone as a result of the reallocation assuming uniform annual repayment."

B.2.5. Emissions Avoided

One of the benefits of hydropower generation is that it is a relatively clean resource that results in few air emissions. A reduction in hydropower generation may require increased generation from thermal plants, resulting in increased emissions.

B.2.6. Scope of Analysis

The generation of the Federal Columbia River Power System (FCRPS) is about 8,721 aMW. USACE Northwestern Division Projects within the FCRPS generate about 6,026 aMW, while the Portland District's Willamette Basin Projects generate about 188 aMW. This study determines that the hydropower impact of meeting the M&I Water Supply requirements in 2050 is about 1 aMW annually, which is about 0.5% of the generation of the Willamette Basin Projects and 0.01% of the FCRPS generation. Impacts of this magnitude are within the commonly accepted error of estimate for modeling of the power system, and therefore are considered negligible. In addition, the impacts will accrue to this level gradually over the period from the present until 2050.

In consultation with BPA Staff, the hydropower impact of using reservoir storage to meet M&I requirements in the Willamette River Basin through 2050 will be based on the computed power benefits foregone. Revenue foregone and cost of replacement power will be assumed to be equal to benefits foregone and no credits will be considered because the magnitude of the impact to hydropower generation of the Willamette River Basin projects is insignificant. In addition, the emissions avoided will be computed.

B.3. POWER BENEFITS FOREGONE

Power benefits foregone include both energy and capacity benefits foregone, which are computed by applying unit values to the potential loss in generation and loss in capacity at the eight hydropower projects in the Willamette River Basin. The On-Peak and Flat energy price (unit value) is the unit cost of producing replacement energy in the regional power system based on the forward market price forecast in the Mid-C (mid-Columbia), the largest and most liquid market hub for electricity in the Pacific Northwest. This energy unit value is applied to the loss in generation to determine the energy benefit foregone.

The capacity unit value is the cost of equivalent thermal capacity which would replace the lost capacity, resulting in the capacity benefit foregone. This capacity unit cost is based on the most likely, least costly, type of thermal generation plant that would replace the Willamette River Basin hydropower generation. This replacement thermal generating resource has been determined in the 6th Northwest Conservation and Electric Power Plan prepared by the Northwest Power and Conservation Council to be a combined-cycle (highly efficient) natural gas-fired combustion turbine generation station.

B.3.1. Energy Benefits

Development of the hydropower energy benefits involves the following steps:

- Run the ResSim model to obtain daily power plant discharges for each alternative.
- Summarize and reformat ResSim output for input to HYDSIM.
- Run the HYDSIM model to obtain average monthly power and generation for each alternative.
- Determine the annualized energy price for the period of analysis based on BPA and EIA forecasts.
- Apply the annualized energy price to the average generation for each alternative.
- Sum the annualized energy value for each alternative to obtain annual energy benefit.

Three computer models are used in the development of an estimate for energy benefits foregone. The ResSim and HYDSIM models are used in estimating the energy loss, and the AURORA model is used in determining the energy price forecast. A description of these three models is provided below, and in subsequent sections the calculation of energy loss and energy price is presented.

ResSim is a sequential streamflow routing computer model that was used to simulate the operation of Willamette River Basin system on a daily time-step according to existing guidelines for reservoir and system operation. The simulations used in the analysis were based on a period of record of 74 years, from 1935 through 2008. Analyses of the ResSim model results are presented in the Hydraulics and Hydrology Appendix C.

HYDSIM simulates power production for the month to month operation of the Columbia River Basin hydropower system. The model is jointly maintained by BPA and BC Hydro. It is used to determine the hydro system generation and resulting project outflows, end of month storage contents, etc., under varying inputs of inflows, power loads, operating procedures and constraints, and physical plant data.

The HYDSIM model is a deterministic model that uses rule curves and flow or storage constraints to achieve operating objectives, especially for power, flood control, fish flows and spill, and recreation. It simulates one period at a time without looking ahead. It uses 14 periods in a year with April and August split into two periods, since these months have significant natural flow differences between their first and second halves. The Willamette Basin portion of HYDSIM was used by BPA to post-process the ResSim modeling to capture hydropower impacts. Daily inflow and outflow (including outflow by outlet) from ResSim were averaged into the 14 periods and used as input to HYDSIM. The model was run in a continuous mode with project initial storage contents for each operating year starting where the previous year ended Monthly average megawatts (aMW) were computed from the average powerhouse flows and end of month elevations for the Period-of-Record.

The HYDSIM model includes both storage and run-of-river projects.

AURORA is an electric energy market model owned and licensed by EPIS Inc., to forecast market clearing prices for electric power. The hourly market-clearing price is based upon a fixed set of resources dispatched in least-cost order to meet demand while subject to emissions limits. The hourly price is set equal to the variable cost of the marginal resource needed to meet the last unit of demand. A long-term resource optimization feature within the AURORA model allows generating resources to be added or retired based on economic profitability. Market-clearing price and the resource portfolio are interdependent. Market-clearing price affects the revenues any particular resource can earn and consequently will affect which resources are added or retired. AURORA sets the market-clearing price using assumptions of demand levels (load) and supply costs. The demand forecast implicitly includes the effect of price elasticity over time. The supply side is defined by the cost and operating characteristics of individual electric generating plants, including resource capacity, heat rate, and fuel price. AURORA recognizes the effect that transmission capacity and prices have on the system's ability to move generation output between areas. Input data to AURORA includes the following: an electricity demand model, coal market model, natural gas market model, new/future generating capacity database, as well as sulphur dioxide (SO_2) and nitrous oxide (NO_x) emissions allowance model.

B.3.1.1. Energy Loss

Monthly average megawatts (aMW) were computed from the average powerhouse flows and end of month elevation for the Period-of-Record. Annual average generation for each project is the weighted average of the period generation (weighting factor is the hours in each period). Annual average generation results from the HYDSIM modeling for the Baseline–Early Implementation and the alternative Meet All M&I (2050) are shown in ***Table B.3.1***, and the detailed monthly tables are included as an attachment to this appendix. Subtotals are provided for the power projects and the flat projects, as well as total annual average generation under each alternative.

Table B.3.1 Average Annual Generation by Project for each Alternative (aMW)

	Base Case-Early Implementation	**Meet All M&I**
Detroit*	40.1	38.8
Big Cliff	10.8	10.7
Cougar	16.0	16.5
Green Peter*	29.6	29.6
Foster	13.6	13.5
Hills Creek	18.6	18.7
Lookout Point*	40.2	40.0
Dexter	9.5	9.6
Subtotals		
*Power Projects	109.9	108.4
Flat Projects	68.5	69.0
TOTAL	**178.4**	**177.4**

Annual average generation under the Base Case-Early Implementation alternative is 178.4 aMW. Under the Meet All M&I alternative, annual average generation is 177.4 aMW, yielding a generation loss of 1 aMW, or about 0.5 percent of total generation.

The three peaking power projects in the Willamette Valley are Detroit, Green Peter, and Lookout Point. These projects have units that are designed to be run fully loaded to meet peak loads, but they do not generate continuously. These peak load periods are referred to as heavy load hours (HLH). These "power" projects all have re-regulation projects downstream so that outflows can be reregulated to a more normative flow. The base flow projects in the Willamette Valley operate more continuously (i.e., "flat") and generate power in both peak load and non-peak load periods, or in market terms both during heavy load hours (HLH) and light load hours (LLH). Heavy and light load hours were estimated by actual historical generation from the past five years. Flat prices were computed as a weighted average of HLH and LLH, a combination of 72 hours of HLH and 96 hours of LLH per 168 hour week.

B.3.1.2. Energy Price

In order to determine the energy benefit foregone, an amortized monthly energy price for the 50-year period of analysis is needed. The energy price for the period of analysis is based on a combination of BPA's monthly 10-year energy price forecast and the U.S. Energy Information Administration (EIA) 30-year annual energy price outlook, seasonally adjusted to account for monthly variation in both the HLH and flat energy price.

The value of energy has a seasonal trend based on demand and generating resource availability throughout the year. Energy prices are highest when seasonal temperatures are lowest, increasing the electrical power demand for indoor heating, and when river flow is lowest at the end of the regional annual dry period, which decreases hydropower generation. Energy prices are lowest as seasonal temperatures begin to warm, reducing demand for heating simultaneous to when snow melt runoff is highest and there is an excess of hydropower. Seasonal shaping factors were developed to capture the variation in monthly energy price and transform an annual forecast.

The EIA annual electrical energy price projection was transformed into a monthly projection by developing monthly shaping factors from the BPA monthly price projection, which characterize the ratio of monthly to annual average price over the forecast period. In addition, price factors reflecting the ratio of the HLH monthly price to the flat monthly price were determined. A long-term electrical energy price forecast for the period of analysis was created by the BPA 10-year forecast for the period 2012-2022 as the base forecast and extending it with the seasonally adjusted EIA forecast for the years 2023-2040. The forecast was extended from 2040 to 2062 to complete the 50-year period of analysis by repeating the last annual cycle of the monthly price, as displayed in Figure B.3.1.

Finally, the HLH and flat energy price for each month of the forecast are amortized to obtain the long-term monthly energy prices for the 50-year period of analysis (

Table B.3.2). The present values of the monthly energy prices are amortized to produce an annualized monthly price. The product of the annualized monthly energy price and energy loss due to water withdrawals represents the annual energy benefits foregone for that alternative.

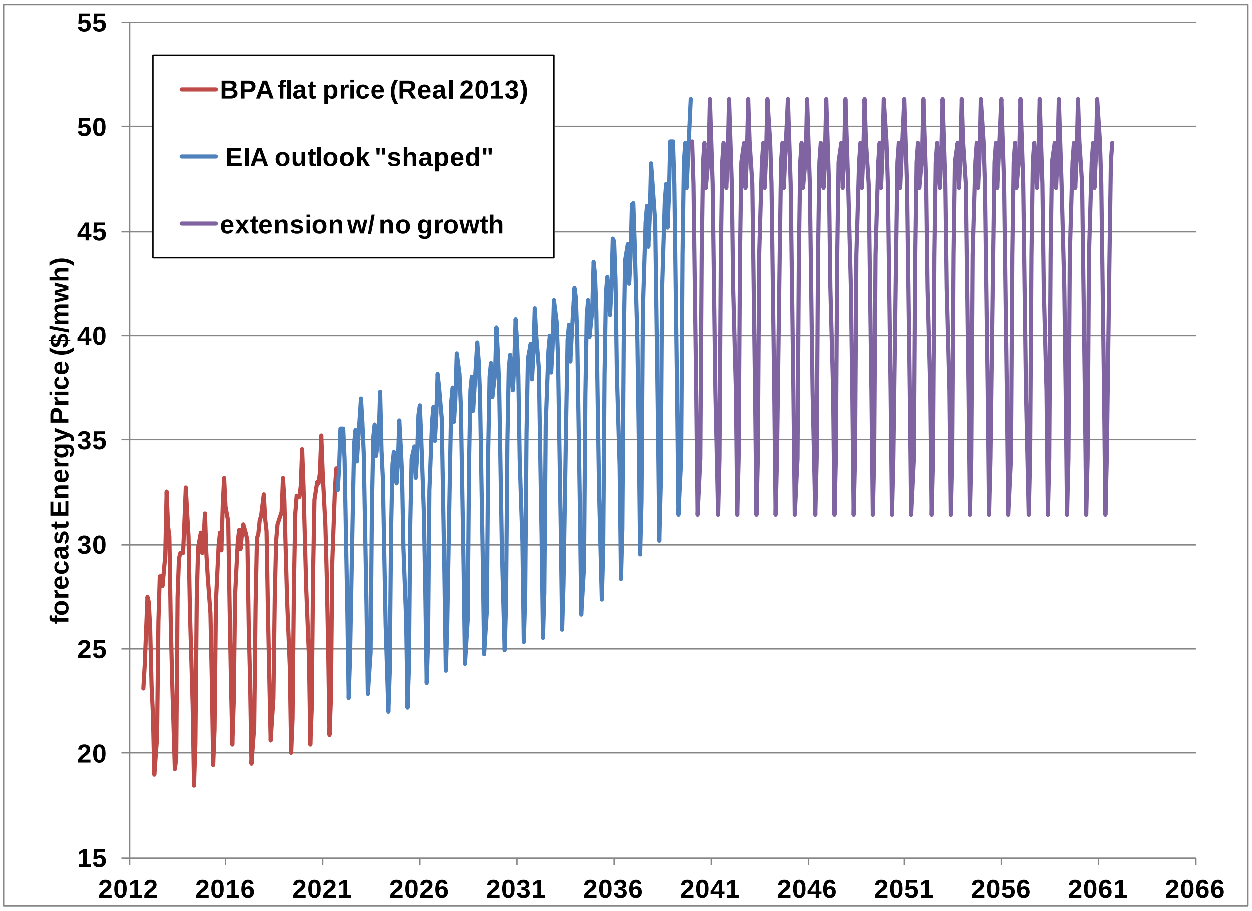

Figure B.3.1 Long-Term Energy Price Projections

Table B.3.2 Long-Term Monthly Energy Prices (2013 dollars)

month	HLH Levelized Price (Real)	flat Levelized Price (Real)
Jan	**$42.92**	**$40.11**
Feb	**$40.70**	**$38.47**
Mar	**$36.44**	**$34.41**
Apr	**$33.03**	**$30.41**
May	**$29.38**	**$25.56**
Jun	**$31.08**	**$27.74**
Jul	**$37.70**	**$35.70**
Aug	**$41.74**	**$39.30**
Sep	**$42.57**	**$40.02**
Oct	**$39.74**	**$37.94**
Nov	**$40.51**	**$39.15**
Dec	**$43.20**	**$41.41**

B.3.1.3. Energy Benefits Foregone

The long-term energy prices described in the previous section were applied to the annual average generation (aMW) to obtain the average annual value of generation for the Willamette Valley Projects for each of the two alternatives. The expected annual energy value generated is $59,709,000 in the Base Case-Early Implementation alternative, and $59,329,000 for the Meet All M&I alternative, as shown in Table B.3.3 and Table B.3.4.

The calculation results displayed in the Tables below are based on average annual power production at each project under current operating regimes and forecasted megawatt-hours generated by power peaking project (power projects) and base load power (flat) projects. The power plants at the large storage projects (Detroit, Green Peter, Lookout Point) are used primarily to generate during peaking hours (HLH), while the power plants at the downstream re-regulating dams (Big Cliff, Foster, Dexter) generate power more continuously throughout the day. The flat price applies to the generation at the re-regulating projects as well as the other power plants in the basin.

Energy benefits foregone is the value of the hydropower generation loss that occurs under an alternative as compared to the base condition. The annual average value of the lost hydropower energy (net-benefit) is approximately $380,000.

Table B.3.3 Value of Generation – Base Case-Early Implementation (x $1,000)

Period	OCT 1-31	NOV 1-30	DEC 1-31	JAN 1-31	FEB 1-28	MAR 1-31	APR 1-15	APR 16-30	MAY 1-31	JUN 1-30	JUL 1-31	AUG 1-15	AUG 16-31	SEP 1-30
subtotals														
Power Project** (aMW)	105.1	171.4	168.7	162.4	93.0	90.8	105.9	100.0	117.7	90.6	59.4	61.8	63.4	92.8
Power Project ($)	$3,108	$4,904	$4,989	$4,801	$2,485	$2,683	$1,515	$1,431	$3,480	$2,592	$1,756	$884	$968	$2,655
Flat (aMW)	70.5	87.9	84.4	84.2	52.2	56.0	69.3	69.5	83.0	71.8	49.5	53.3	53.5	58.5
Flat ($)	$1,990	$2,479	$2,600	$2,512	$1,349	$1,433	$759	$761	$1,579	$1,435	$1,315	$754	$808	$1,684
Total $	$59,709													

Table B.3.4 Value of Generation – Meet All M&I-2050 (x $1,000)

Period	OCT 1-31	NOV 1-30	DEC 1-31	JAN 1-31	FEB 1-28	MAR 1-31	APR 1-15	APR 16-30	MAY 1-31	JUN 1-30	JUL 1-31	AUG 1-15	AUG 16-31	SEP 1-30
subtotals														
Power Project** (aMW)	86.2	163.0	168.0	160.6	87.3	90.1	105.8	99.8	118.0	95.0	67.2	71.9	78.4	86.2
Power Project ($)	$2,548	$4,664	$4,967	$4,750	$2,332	$2,664	$1,513	$1,428	$3,488	$2,719	$1,988	$1,029	$1,197	$2,466
Flat (aMW)	60.6	85.2	84.1	84.2	51.5	55.9	69.2	69.3	83.2	76.6	56.4	59.7	59.3	60.2
Flat ($)	$1,712	$2,401	$2,592	$2,512	$1,331	$1,430	$758	$759	$1,582	$1,531	$1,497	$845	$895	$1,733
Total $	$59,329													

B.3.2. Capacity Benefits

Capacity benefits foregone are defined as the product of the loss in dependable capacity and a capacity unit value. The capacity unit value represents the capital cost of constructing replacement thermal capacity. The evaluation of capacity benefits assumes the following:

- Plant capacity is not considered lost until monthly average generation drops below 6 aMW at the three power projects.
- The value of capacity is based on the capital replacement cost of the marginal replacement resource, which is a highly efficient combined cycle combustion turbine generating station.

B.3.2.1. Capacity Loss

Three power projects in the Willamette Valley (Detroit, Green Peter, and Lookout Point) can be scheduled to provide energy to meet morning and evening peak loads (HLH). They also provide standby capacity that can be called up to provide more or less energy depending on the needs of the loads that BPA serves. A capacity loss is incurred when there is insufficient energy meet system load, which occurs when generation drops below 6 aMW at the peaking plants. Generation loss of this magnitude is not anticipated under the Meet All M&I alternative, therefore no capacity loss occurs.

B.3.2.2. Capacity Value

The value of the loss of capacity is based on the capital replacement cost of the marginal replacement resource, which is either a single cycle or a combined cycle combustion turbine. The estimate of these capital costs is estimated by the Northwest Power and Conservation Council, and results in a monthly capacity value of about $6,605/MW. If the peaking plant's generation drops below 6 aMW during a month, the cost of the foregone capacity would be the product of $6,605 and the project's capacity.

B.3.2.3. Capacity Benefits Foregone

There is no capacity loss anticipated under the Meet All M&I alternative, therefore there are no capacity benefits foregone.

B.3.3. Benefits Foregone

Hydropower benefits foregone are the sum of the energy benefits foregone and the capacity benefits foregone, which is estimated in this analysis to be $380,000.

B.4. EMISSIONS OF REPLACEMENT POWER

Hydropower is a relatively clean electric power generating resource that results in few air emissions. Replacing any or all of the Willamette Basin projects' hydropower generation may require increased generation from thermal plants. Generating resources are typically brought on line or taken off line in order of their operating costs in wholesale power markets. Resources that have low operating costs are favored, and include hydroelectric, nuclear, and wind resources. Higher plant operating cost resources include thermal plants using fossil fuels such as coal, oil, and natural gas. To achieve cost-effective production, resources are typically used in order where lowest cost resources are used first and highest cost resources are used last. The amounts of and types of resources that are actually used vary depending on the amount of energy demand in the system. Therefore, the marginal resource varies by the time of the day and day of the week, as energy needs rise and fall.

In 2008, the PNW Power and Conservation Council prepared a report titled, "Marginal Carbon Dioxide rates of the Northwest Power System". The Council Report concludes that gas-fired power plants with relatively high operating costs are on the margin during heavy load hours, while coal is typically the resource on the margin during light load hours on nights and weekends. The Council Report estimates that the marginal production rate of carbon dioxide (CO_2) from these resources is approximately 900 pounds of CO_2 per megawatt hour of generation. Thus, the reduction of regional hydroelectric generation associated with a given operation will increase the amount of energy produced with thermal power plants and increase the amount of CO_2 produced by 900 pounds per MWh.

Meeting all the identified Municipal and Industrial Water Supply demand by 2050 would result in a regional increase in CO2 emissions by 3,402.5 metric tons annually (Table B.4.1 below).

Table B.4.1 CO_2 Emissions due to Lost Hydropower Generation

Annual Average Generation

ALTERNATIVE	Base Line (aMW)	Meet All M&I (aMW)	difference (aMW)
PROJECT			
Detroit	40.1	38.8	1.2
Big Cliff	10.8	10.7	0.1
Cougar	16.0	16.5	-0.5
Green Peter	29.6	29.6	0.0
Foster	13.6	13.5	0.0
Hills Creek	18.6	18.7	0.0
Lookout Pt	40.2	40.0	0.2
Dexter	9.5	9.6	0.0
Total (aMW)	178.4	177.4	1.0

Emissions Computation

x	8,760	hrs
	8,334.9	mwh
x	900	lbs CO_2/mwh
	7,501,413.7	lbs CO_2
/	2204.6	lbs/metric tonne
	3,402.6	metric tonnes CO_2

ATTACHMENTS

Table B.4.2 Willamette Basin Review - Base Case-Early Implementation, aMW

Period	OCT 1-31	NOV 1-30	DEC 1-31	JAN 1-31	FEB 1-28	MAR 1-31	APR 1-15	APR 16-30	MAY 1-31	JUN 1-30	JUL 1-31	AUG 1-15	AUG 16-31	SEP 1-30	Annual Average
PROJECT															
Detroit**	43.3	71.1	63.9	64.2	44.9	38.0	39.8	31.4	30.6	23.6	18.0	17.2	18.0	30.6	40.1
Big Cliff	11.5	15.7	13.8	13.7	9.6	8.9	10.2	10.3	12.5	10.8	7.3	6.0	6.1	9.6	10.8
Cougar	17.4	19.3	17.6	17.6	11.5	12.3	14.7	15.4	19.6	17.8	14.5	16.5	16.5	12.2	16.0
Green Peter**	19.3	41.5	59.0	50.0	20.1	25.3	32.5	31.7	33.7	20.7	13.8	15.0	15.3	24.0	29.6
Foster	11.6	16.5	19.6	18.0	12.1	14.9	19.1	16.3	15.2	12.2	7.1	6.9	7.0	10.9	13.6
Hills Creek	19.2	22.9	21.4	22.3	12.2	13.2	17.6	19.2	25.0	21.3	14.2	17.0	16.7	16.3	18.6
Lookout Pt**	42.5	58.8	45.8	48.1	28.0	27.5	33.6	37.0	53.4	46.3	27.6	29.5	30.1	38.2	40.2
Dexter	10.8	13.5	12.0	12.5	7.0	6.7	7.8	8.3	10.7	9.7	6.5	7.0	7.2	9.5	9.5
subtotals															
Power Projects**	105.1	171.4	168.7	162.4	93.0	90.8	105.9	100.0	117.7	90.6	59.4	61.8	63.4	92.8	109.9
Flat	70.5	87.9	84.4	84.2	52.2	56.0	69.3	69.5	83.0	71.8	49.5	53.3	53.5	58.5	68.5
Total	175.6	259.3	253.2	246.5	145.2	146.7	175.2	169.5	200.7	162.4	108.9	115.0	117.0	151.2	178.4

Table B.4.3 Willamette Basin Review – Meet All M&I (2050), aMW

Period	OCT 1-31	NOV 1-30	DEC 1-31	JAN 1-31	FEB 1-28	MAR 1-31	APR 1-15	APR 16-30	MAY 1-31	JUN 1-30	JUL 1-31	AUG 1-15	AUG 16-31	SEP 1-30	Annual Average
PROJECT															
Detroit**	32.6	67.0	63.5	62.4	38.9	37.2	39.8	31.2	30.7	25.2	21.1	21.5	24.4	29.2	38.8
Big Cliff	9.5	14.9	13.6	13.6	8.8	8.8	10.2	10.2	12.5	11.3	8.2	7.9	7.8	9.6	10.7
Cougar	14.6	18.6	17.6	17.7	11.5	12.3	14.7	15.5	19.7	20.1	18.0	18.2	17.5	14.7	16.5
Green Peter**	18.7	40.8	58.7	50.0	20.4	25.4	32.5	31.7	33.8	21.5	14.4	15.8	19.5	21.0	29.6
Foster	11.5	16.3	19.5	17.9	12.1	14.8	19.0	16.2	15.2	12.5	7.1	7.0	8.5	9.9	13.5
Hills Creek	15.8	22.7	21.4	22.4	12.2	13.2	17.6	19.3	25.2	22.5	15.5	18.3	16.9	16.6	18.7
Lookout Pt**	34.9	55.2	45.8	48.2	28.0	27.5	33.6	37.0	53.5	48.4	31.8	34.6	34.5	36.0	40.0
Dexter	9.2	12.7	12.0	12.5	7.0	6.7	7.8	8.3	10.7	10.2	7.5	8.4	8.5	9.4	9.6
subtotals															
Power Projects**	86.2	163.0	168.0	160.6	87.3	90.1	105.8	99.8	118.0	95.0	67.2	71.9	78.4	86.2	108.4
Flat	60.6	85.2	84.1	84.2	51.5	55.9	69.2	69.3	83.2	76.6	56.4	59.7	59.3	60.2	69.0
Total	146.8	248.2	252.1	244.8	138.8	145.9	175.0	169.2	201.2	171.6	123.6	131.6	137.7	146.3	177.4

APPENDIX C HYDROLOGY AND HYDRAULICS

C.1. HYDROLOGY AND HYDRAULICS

C.1.1. Background

The Willamette River Basin was modeled using the Hydrologic Engineering Center (HEC) Reservoir System Simulation Program (ResSim) to assess the individual project and system effects of using 499 ac-ft of the stored water in Cottage Grove and Dorena reservoirs for Municipal and Industrial (M&I) water supply for the City of Creswell. These two reservoirs are important components of the Willamette Basin system, used for both flood damage reduction operations and to supply water that helps meet minimum flow targets for the Willamette River at Albany and Salem.

The ResSim program was also used to analyze the system-wide impacts of using stored water in the eleven Willamette storage projects to meet projected M&I needs in 2050. The results from this 2050 analysis were used in the cost analysis to determine the price structure for using 499 ac-ft of storage in the Willamette Project.

The ResSim model used for this study was adapted from the model used for an intense modeling effort under the Willamette Configuration and Operation Planning (COP) project, a major part of the Willamette Biological Opinions (BiOps) implementation. The baseline ResSim model used for the COP studies is detailed in the "Model Documentation Report of the Willamette Basin HEC-ResSim Model." The Model Documentation Report identifies all of the physical parameter inputs for the thirteen reservoirs in the basin, the routing reach specifications, the inflow time series used, and the operation sets (the rules used in the ResSim model to regulate the thirteen projects) of the baseline model of the Willamette Basin.

The baseline model refers to the simulation, with its associated operation sets (or rule sets) used at each project, that mimics the way the Willamette Basin projects are operated currently. This includes physical capacity information for all project outlets, special operations at each project during high inflow events, project rule curves, the minimum flow targets for tributaries and the mainstem, and outflow rates of change (ramping rates) identified in the Willamette BiOp for listed fish, and the current Interim Risk Reduction Measures (IRRMs) at specific projects in the basin.

Interim Risk Reduction Measures (IRRMs) are in place at many of the projects in response to spillway Tainter gate deficiencies. The IRRMs primarily impact project operations during high inflow events, except at Lookout Point, where the maximum conservation pool has been lowered to 915 feet until spillway gates are repaired. The IRRMs are considered to be a short-term operational change until the spillway gates are repaired and were, therefore, not included in the model for this study as storage reallocated will be long-term.

The operations to meet the minimum flows from the BiOp, along with ramping rates, are referred to as Early Implementation operations which are detailed below. The project inflows and the local stream flows into the system are also described below; however, the Model Documentation Report should be referred to for most of the details associated with the baseline model.

C.1.2. ResSim Model Description

ResSim is used to model reservoir systems whose operations are defined by a variety of goals and constraints. The model uses a rule-based description of the operational goals and constraints that reservoir operators must consider when making release decisions. The dam is the root of an outlet hierarchy or "tree" which allows the user to describe the different outlets of the reservoir in as much detail as necessary. The ResSim model is not an optimization tool and can only be used to simulate rule-based reservoir operations input by the modeler. The model does not run in a forecast mode, it makes decisions based on modeled system status and inflows. Additional information on the ResSim model is available on the US Army Corps of Engineers Hydrologic Engineering Center (HEC) website (http://www.hec.usace.army.mil/).

All projects in ResSim are configured with their physical constraints and capabilities. Geographic information, such as river mile location and elevation above sea level can also be specified, but the program does not include a true geospatial component. Each reservoir also has an operation set associated with it. The operation set is first broken into zones, based on pool elevation as a function of date, and then a set of instructions within that zone describes how the reservoir is operated. These instructions are called rules, and are prioritized within each zone. The model calculates each reservoir's flow release at each time step to meet the highest priority rule possible based on the physical capability for that project. The program progresses through each time step calculation until the simulation is complete.

C.1.3. Inflows and Local Flows

The Corps' Portland District Hydrologic and River Engineering Section (EC-HY) developed a 73-year data set of Willamette project inflows and local flows on a daily time step. This Period of Record (POR) dataset contains historical data from October 1935 through 2009. The data for 2009 was still being finalized at the beginning of the COP ResSim modeling effort, so the baseline analysis mentioned in the Background section used flow inputs for October 1935 through December 2008. A large number of model variables from the baseline were selected to be used for comparison with any additional analyses, and these variables were processed to obtain statistical parameters and counts of occurrences. Any ResSim models that are to be compared to the baseline data should use the same period of analysis (October 1935 through December 2008) even when additional years of inflow data are available. The phrase Period of Record, or POR, in this report will always refer to the window of a 1 October 1935 start and a 31 December 2008 end, which is just over 73 years of daily data.

The Period of Record flows were entered into the model as unregulated daily average inflows at the projects and local flows at the control point locations. The development of this flow data set is fully documented in Appendix Section 8.3 of the report titled "Hydrology Report Willamette FIS Update (Phase One)." This report is available from the Corps.

Several large flood events within this POR are available in hourly data also, but hourly data is not available for the lower flow periods of the year. Since Willamette Basin system performance must be evaluated in all types of flow regimes, the continuous daily average data is well suited for the type of results required for a water supply analysis. This continuous POR reservoir and local inflows includes wide variability in project inflows, representing high flow and the low flow water years.

The ResSim model does not reproduce the regulated flows that really occurred; instead, the model produces regulated flows that would have occurred if specified project operations were used for the historical inflows. There are multiple reasons for this, including that the POR covers pre-dam periods, the dams began their Early Implementation operations around 2007, and the model does not include various restrictions on flow or pool levels required for any maintenance or construction operations that have occurred over the years. In other words, the simulated POR in ResSim models the regulated flows that would have happened in 1935-2008 if all projects existed and operated according to the operation sets input into the model.

C.1.4. Water Year Classification

The POR spans 73 years and encompasses a variety of wet and dry water years. Appendix B of the "Willamette Project Supplemental Biological Assessment" designates four water year classifications that are used to determine the mainstem Willamette minimum flow targets for April through October. The four classifications are Abundant, Adequate, Insufficient, and Deficit.

The year classification is based on the storage volume targets of the federal projects in the Willamette Basin for each day of May 10 through 20 of any year. The storage volume is determined by adding usable conservation storage in all the reservoirs (not counting the reregulating dams of Big Cliff and Dexter). The peak composite system storage that occurs from May 10 - 20 of each year is then used to classify the water year type. If this volume is less than 0.9 million acre-feet (MAF), the year is designated as Deficit. If the storage volume is between 0.9 and 1.19 MAF, the year is designated as Insufficient. Storage volumes from 1.20 to 1.48 MAF are designated as Adequate, and all years with storage volumes greater than 1.48 MAF are designated as Abundant. The maximum useable conservation storage is 1.59 MAF.

The Insufficient and Deficit water years have reduced minimum flow targets at Salem. The 73 years in the POR were classified using this system in order to have a variable minimum flow target in a downstream rule for Salem and to determine when some of the diversions used in the model (where water is removed from the system) are reduced in the lower water years.

C.1.5. Study Methodology

The methodology used for this water supply study is a three step process that includes decisions made by members of the Product Delivery Team (PDT):

- *Step 1:* Run the Early Implementation Baseline. Data from this baseline is used to establish flow and elevation statistics that will be used for comparisons for other system operations as well as costs.
- *Step 2:* Add a single diversion on the Coast Fork to represent the water needs addressed in this study (499 acre-feet for the City of Creswell). Supply the stored water from Dorena and Cottage Grove reservoirs by specifying greater outflows from these projects to meet the diversion. Run the simulation described in Step 2 and compare results to the Early Implementation Baseline results to assess impacts to the system and the individual projects.
- *Step 3:* Input the projected M&I needs for 2050 as additional diversions and use water from storage projects to meet the modeled demand. Specify stored water releases from hydropower projects whenever possible to obtain the worst case possible for hydropower impacts. Use the modeled results in the system wide cost analysis and compare system behavior with the baseline.

C.1.5.1. Step 1. Set Up the Early Implementation Baseline

The baseline model from the Willamette COP project was used as the starting point for the water supply study. A new network was created by duplicating the IRRM Baseline network, naming it the Early Implementation Network, and then modifying the project operation sets. A small number of changes were made to improve the modeling at other projects as well. The changes from the IRRM Baseline are summarized as follows:

- Detroit – removed Interim Risk Reduction Measure (IRRM) specific spill in high event winter inflows.
- Big Cliff – changed the pool elevation from 1193 ft. (IRRM elevation) to 1197 ft.
- Green Peter – removed the IRRM specific spill in high event winter inflows.
- Foster – added a variable minimum outflow rule that is a two-way lookup table that interpolates low releases more smoothly than the IRRM Baseline, and helps Green Peter to also operate more smoothly with fewer days of zero outflow.
- Cougar - removed IRRM specific spill in high event winter inflows.
- Blue River - removed IRRM specific spill in high event winter inflows.
- Hills Creek - removed IRRM specific spill in high event winter inflows.
- Lookout Point - removed IRRM specific spill in high event winter inflows and raised the maximum conservation pool elevation from 915 ft. to 926 ft.
- Dexter – changed the pool elevation from 691 ft. to 693 ft.
- Fall Creek - removed IRRM specific spill in high event winter inflows.
- Cottage Grove – fixed an error in the Special Curves release specification.
- Dorena – fixed an error in the Special Curves release specification.
- Fern Ridge – fixed an error in the Special Curves Induced Surcharge-Falling Pool Options from 6 hours to 24 hours.

Once these changes were made to the model, a new simulation referred to as the Early Implementation Baseline was run. The results from this simulation were then used for comparison against the other simulations for the water supply study. Table C.1.1 below lists the details of the Early Implementation Baseline simulation.

Table C.1.1 Early Implementation Baseline ResSim Simulation Details.

ResSim Version	HEC-ResSim 3.1 RC3 Build 101	**Watershed**	Willamette3
Network	Early Implementation Network		
Configuration	Existing	**Alternative**	Early Imp
Inflow File Name	Daily Series – 13Apr2011.dss		
Rule Curve File	Willamette_Rule_Curves.dss		
External Variables File	year_classifications.dss		
Simulation Name	Early-Implementation-01-29-13		
Simulation Start **Simulation Lookback**	04 Oct 1935 at 2400 01 Oct 1935 at 2400	**Simulation Ending**	31 Dec 2008 at 2400

Project	**Operation Set Name**	**Lookback Elevation**	**Lookback Flows (cfs)**
Detroit	New Early Imp	Rule Curve	Power Plant 1573.0, Spillway and ROs 0.0
Big Cliff	Early Imp	1193.0 ft	Power Plant 1573.0, Spillway 0.0
Green Peter	Early Implementation rule set	Rule Curve	Power Plant 1500.0, Spillway and RO 0.0
Foster	Early Implementation and Fish Weir	Rule Curve	Power Plant 1500.0, Spillway 0.0
Cougar	Early Implementation	Rule Curve	Power Plant 400.0, Spillway and RO 0.0
Blue River	New Early Imp	Rule Curve	RO 50.0,Spillway 0.0
Hills Creek	Early Imp	Rule Curve	Power Plant 1200.0, Spillway and ROs 0.0
Lookout Point	LOP Early Imp	Rule Curve	Power Plant 1200.0, Spillway and ROs 0.0
Dexter	Early Imp	693.0 ft	Power Plant 1200.0, Spillway 0.0
Fall Creek	Early Imp	Rule Curve	RO 200.0, Spillway 0.0
Cottage Grove	Early Imp	Rule Curve	RO 50.0, Spillway 0.0
Dorena	Early Imp	Rule Curve	RO 100.0, Spillway 0.0
Fern Ridge	New Early Imp	Rule Curve	RO 30.0, Spillway and Sluice Gate 0.0

Notes:

1. Lookback flows and elevations refer to the initial conditions at the start of the simulation. .

A screen shot of the reservoir network used for the Early Implementation Baseline is shown in Figure C.1.1 below. Note that this network has only one diversion included, which is at Mehama. The diversion is indicated by a heavy-lined arrow pointing away from the river. This diversion was part of the COP IRRM Baseline, which diverts 73 cfs from the North Santiam for irrigation use from the first of April to the end of October. The diversion at Mehama in the Early Implementation Baseline is the only irrigation diversion needed to represent current irrigation demand since all other current irrigation needs are met with the minimum releases specified at projects.

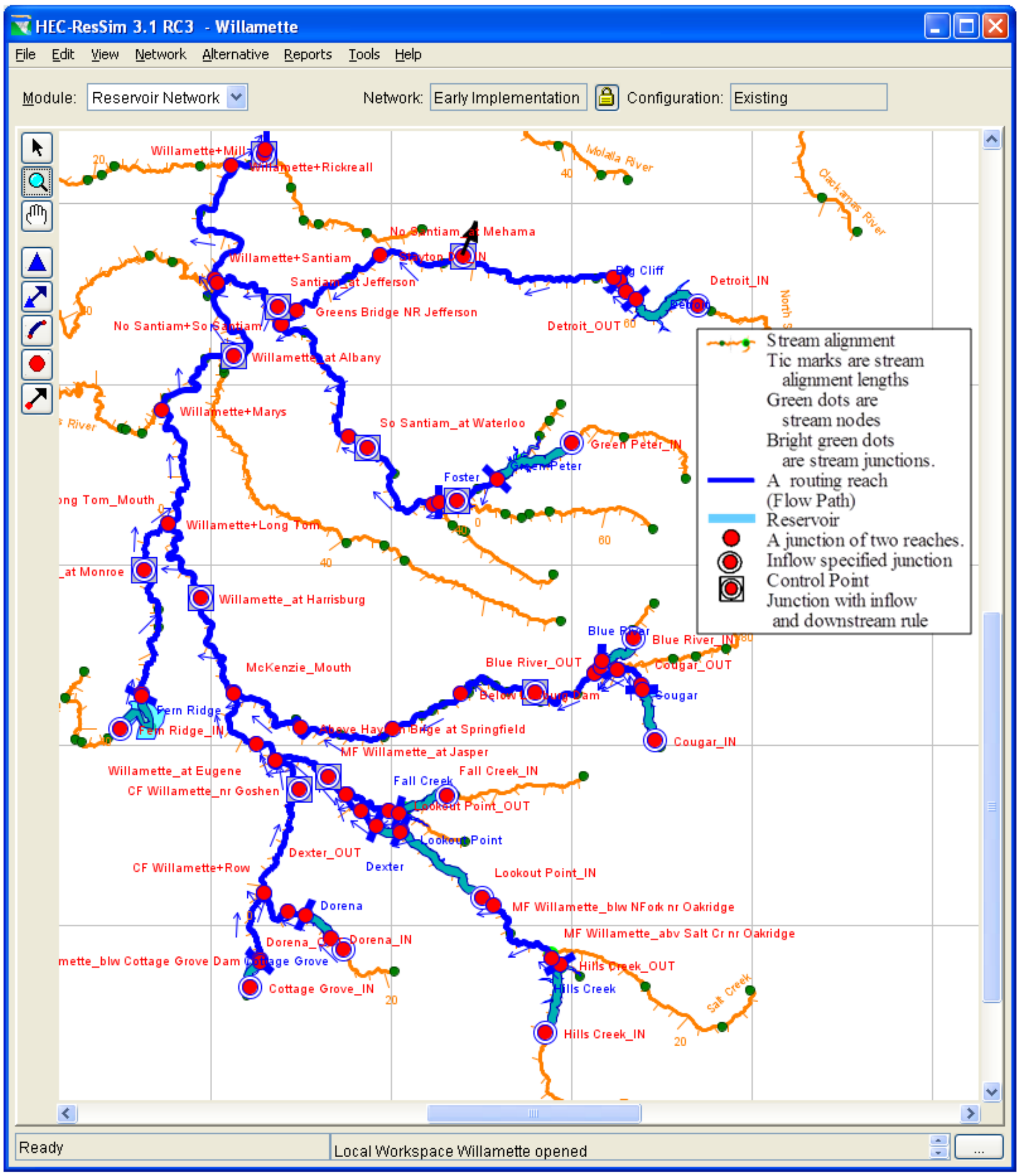

Figure C.1.1 Screen Shot of the Network used for the Early Implementation Baseline.

C.1.5.2. Step 2. Assess Impact of the Stored Water Request on Current Configuration

The ResSim analysis for the use of stored water adds a single diversion at Goshen, which is downstream of both Cottage Grove and Dorena, to the Early Implementation Network. The water that is diverted from the system for municipal and industrial use is to be supplied from stored water within the Coast Fork subbasin reservoirs. In order to use stored water for these diversions, the model must include rules that tell the reservoirs to let that water demand out, in addition to what the project would have already computed as a release. The operation sets of those reservoirs supplying water must be modified to let out flow of the same magnitude and for the same period of time as the water that is diverted from the system. This is accomplished by increasing the project minimum release value by the same amount that is diverted downstream. For another very simplified example, ignoring all routing, timing, and so on, if a project minimum release is 400 cfs, and downstream diversions require 100 cfs from that reservoir, the project will now release 500 cfs as a minimum. This rule does not affect any computed flows higher than the new minimum release specification.

Table C.1.2 below lists the particulars of this simulation. The 499 acre-feet storage request is assumed to be evenly distributed from June through September, which amounts to just over 2 cfs of flow diverted at Goshen. This is shown in Table C.1.3 below. Both Cottage Grove and Dorena dams can supply water at the location desired. For modeling purposes, the contribution from each project was divided proportionally based on the amount of conservation storage available in each project. The flow contributions at Cottage Grove and Dorena, shown in Table C.1.4, are added to the minimum project flows during June through September.

Table C.1.2 Use of 499 ac-ft of Stored Water ResSim Simulation Details.

ResSim Version	HEC-ResSim 3.1 RC3 Build 101	**Watershed**	Willamette3
Network	Early Implementation Network		
Configuration	Existing	**Alternative**	499CF
Inflow File Name	Daily Series – 13Apr2011.dss		
Rule Curve File	Willamette_Rule_Curves.dss		
External Variables File	year_classifications.dss		
Simulation Name	CF-499-ac-ft-041513		
Simulation Start **Simulation Lookback**	04 Oct 1935 at 2400 01 Oct 1935 at 2400	**Simulation Ending**	31 Dec 2008 at 2400

Project	**Operation Set Name**	**Lookback Elevation**	**Lookback Flows (cfs)**
Detroit	New Early Imp	Rule Curve	Power Plant 1573.0, Spillway and ROs 0.0
Big Cliff	Early Imp	1193.0 ft	Power Plant 1573.0, Spillway 0.0
Green Peter	Early Implementation rule set	Rule Curve	Power Plant 1500.0, Spillway and RO 0.0
Foster	Early Implementation and Fish Weir	Rule Curve	Power Plant 1500.0, Spillway 0.0
Cougar	Early Implementation	Rule Curve	Power Plant 400.0, Spillway and RO 0.0
Blue River	New Early Imp	Rule Curve	RO 50.0,Spillway 0.0
Hills Creek	Early Imp	Rule Curve	Power Plant 1200.0, Spillway and ROs 0.0
Lookout Point	LOP Early Imp	Rule Curve	Power Plant 1200.0, Spillway and ROs 0.0
Dexter	Early Imp	693.0 ft	Power Plant 1200.0, Spillway 0.0
Fall Creek	Early Imp	Rule Curve	RO 200.0, Spillway 0.0
Cottage Grove	COT 499ac-ft Request	Rule Curve	RO 50.0, Spillway 0.0
Dorena	DOR 499ac-ft Request	Rule Curve	RO 100.0, Spillway 0.0
Fern Ridge	New Early Imp	Rule Curve	RO 30.0, Spillway and Sluice Gate 0.0

Notes:

1. Lookback flows and elevations refer to the initial conditions at the start of the simulation.

Table C.1.3 Stored Water Usage Each Month.

Municipal Projected Need	**June (ac-ft)**	**July (ac-ft)**	**August (ac-ft)**	**September (ac-ft)**	**Equivalent Flow Every day of Month**	**Volume (ac-ft)**
Goshen	123	126.5	126.5	123	2.06 cfs	499

Table C.1.4 Flow Contributions from Reservoirs Upstream of Creswell.

Projects Supplying Demand	Conservation Storage (acre -feet)	Relative Storage Proportion	Stored Flow Released (cfs)
Cottage Grove (COT)	28,661	0.307	0.63
Dorena (DOR)	64,745	0.693	1.43

Notes:

1. Relative Storage Proportion is the individual project storage/total storage of all projects used to meet demand.
2. Stored Flow Released is equal to the equivalent flow times the storage proportion. Stored flow released June – Sept.
3. No reduction is assumed for municipal needs during deficit years.

C.1.5.3. Step 3. Assess Impact of Using Stored Water for the Projected 2050 M&I Demand

The ResSim analysis for the use of water from all Willamette Project storage reservoirs to meet 2050 projected M&I demand has multiple diversions added to the network. Municipal diversions were added separately from industrial diversions, applied at control points downstream of reservoirs and on the mainstem. Model rules were written that require the reservoirs to release water to meet the demand, in addition to what the project would have already computed as a release. These rules do not affect any computed flows higher than the new minimum release specification.

The 2050 irrigation demands were not modeled for this report because it was desired to keep the cost associated with the future municipal and industrial demand separate from the cost of future irrigation demand. Future stored water demands will have costs associated with reduced hydropower and recreation impacts due to lower reservoir levels, for example. Future studies may assess the impact of greater irrigation demand, with or without greater M & I demand, as needed for any future cost analyses. The cost analysis for this report, however, was to assess the worst case hydropower losses as relates to municipal and industrial demand.

Table C.1.5 is list of estimated future municipal and industrial demand from the Interim Report referenced earlier. That report presented the demand at various locations in terms of a volume of water needed June through September. In the table below, this volume is converted to an equivalent flow during the same period. July and August volumes are slightly higher than June and September volumes, but that is because those months are one day longer.

The future municipal and industrial demands were modeled as diversion flows applied at the locations given in Table C.1.6 below. Almost all diversions were specified at associated control points. The exceptions were: Salem municipal, which physically occurs at Stayton, and Wilsonville and Oregon City demands, which were applied at Salem. The model has null routing reaches below Salem, with no additional inflows downstream of that point. The Wilsonville and Oregon City demands are taken out at Salem, since their demand must be satisfied by upstream reservoirs.

Diverting Wilsonville and Oregon City demands at the Salem control point is a conservative assumption for the worst case hydropower cost analysis. When a control point has both a downstream control rule and a diversion associated with it, the ResSim model will first remove the diverted flow from the point and then increase project outflows to satisfy a specified minimum at the control point. As a very simplified example, ignoring timing, routing, losses, etc, if the regulated flow entering a control point is 500 cfs, the local inflow at that point is 200 cfs, and a diversion at that point is 50 cfs, the flow at that point is computed as 500 + 200 - 50, or 650 cfs. If that point has a minimum 800 cfs downstream rule associated with it, say at Project A upstream, then the program has Project A release an additional 150 cfs to meet the minimum. The control point at Salem is a mainstem flow target location for the BiOp. With Wilsonville and Oregon City demand being taken out at Salem, their combined ~ 240 cfs is removed before project releases are adjusted to meet minimum target rules. This conservative assumption is desired since it is a worst case hydropower loss that is being computed, and because one or both cities could theoretically build long pipelines to remove water far upstream of their geographic locations.

Table C.1.5 Estimate Future Demands in 2050 for Municipal and Industrial Needs.

Municipal Projected Need	**June (ac-ft)**	**July (ac-ft)**	**August (ac-ft)**	**September (ac-ft)**	**Equivalent Flow Every day of Month**	**Volume (ac-ft)**
Goshen	219	226	226	219	3.68 cfs	891
Jasper	86	89	89	86	1.45 cfs	350
Vida	6259	6468	6468	6259	105.19 cfs	25,454
Harrisburg	89	92	92	89	1.50 cfs	363
Monroe	59	61	61	59	0.99 cfs	241
Albany	3445	3560	3560	3445	57.90 cfs	14,012
Waterloo	447	462	462	447	7.51 cfs	1817
Mehama	5600	5787	5787	5600	94.11 cfs	22,773
Jefferson	49	50	50	49	0.82 cfs	198
Salem	2122	2193	2193	2122	240.47 cfs	8,631
Wilsonville	8288	8565	8565	8288	139.28 cfs	33,706
Oregon City	6021	6221	6221	6021	101.19 cfs	24,484
Total						**132,920**
Industrial Projected Need	**June (ac-ft)**	**July (ac-ft)**	**August (ac-ft)**	**September (ac-ft)**	**Equivalent Flow Every day of Month**	**Volume (ac-ft)**
Harrisburg	6447	6662	6662	6447	108.35 cfs	26,218
Albany	5526	5710	5710	5526	92.87 cfs	22,472
Salem	4789	4949	4949	4789	80.48 cfs	19,476
Oregon City	1658	1713	1713	1658	27.86 cfs	6,742
Total						**74,908**

Table C.1.6 Location in Network Where Diversions Occur for Projected Needs.

Municipal Projected Need at:	**Network Diversion Location:**
Goshen	Goshen Control Point
Jasper	Jasper Control Point
Vida	Vida Control Point
Harrisburg	Harrisburg Control Point
Monroe	Monroe Control Point
Albany	Albany Control Point
Waterloo	Waterloo Control Point
Mehama	Mehama Control Point
Jefferson	Jefferson Control Point
Salem	Stayton Junction (where physical intake was built for Salem)
Wilsonville	Salem Control Point (Model inputs end at Salem d/s location)
Oregon City	Salem Control Point (Model inputs end at Salem d/s location)
Industrial Projected Need at:	**Network Diversion Location:**
Harrisburg	Harrisburg Control Point
Albany	Albany Control Point
Salem	Salem Control Point
Oregon City	Salem Control Point (Model inputs end at Salem d/s location)

The water that is diverted from the system for municipal and industrial use is to be supplied from stored water within the basin reservoirs. In order to use stored water for these diversions, the model must include rules that tell the reservoirs to let that water demand out, in addition to what the project would have already computed as a release. The operation sets of those reservoirs supplying water must be modified to let out flow of the same magnitude and for the same period of time as the water that is diverted from the system. This is accomplished by increasing the project minimum release value by the same amount that is diverted downstream. For another very simplified example, ignoring all routing, timing, and so on, if a project minimum release is 400 cfs, and downstream diversions require 100 cfs from that reservoir, the project will now release 500 cfs as a minimum. This rule does not affect any computed flows higher than the new minimum release specification.

The cost of storage in the Willamette Basin System will be determined using a worst case hydropower decrease for the system. This means that wherever possible, the specified releases of stored water will occur at hydropower projects. At some locations this will not be possible, such as at Monroe, which can only be supplied by the reservoir at Fern Ridge. Additionally, a larger reservoir should supply a larger share of the stored water released for the diversions.

For a very simplified example of these assumptions, assume Point P has a diversion of 75 cfs and there are two reservoirs, A and B, upstream of P that can supply the stored water. If Reservoir A has 100 KAF of storage and Reservoir B has 50 KAF of storage, then proportional releases of stored water from A should be twice the quantity of the stored water released from B, or 50 cfs and 25 cfs, respectively, for this very simple example. When accounting for hydropower, if both reservoirs have hydropower projects, the share of flows is still 50 cfs and 25 cfs, for A and B respectively. If there is not a hydropower project at either dam, then the share is also 50 cfs from A and 25 cfs from B. However, if only one of the two dams has hydropower production, then all 75 cfs is assumed to be supplied by dam releases from the one with hydropower, and the other project will not be drawn on to release stored water for the diversion.

Table C.1.7 and Table C.1.8 below have lists of the flow contribution from each upstream hydropower project to the future municipal and industrial demand for each location. The relative storage contribution (storage at maximum conservation pool minus the dead storage) of each project is shown. It is assumed that municipal demands are not reduced in deficit water years, which is a conservative estimate for the worst case scenario used for the cost analysis. It is assumed that industrial demands are reduced in deficit water years to 77% of their estimated demand. This percentage is based on an average percentage reduction of the Salem minimum flows for fish during deficit water years.

The flow contributions for each project are summed to give a total for each project, which are the flows that are specified in ResSim to be released to meet the diversions. The sum of each project's flow contribution is added to the minimum flow already specified in the model, so that more stored water is being released to meet the demands. For example, the sum of all flow contributions from Cougar is 198.94 cfs in most years, and 186.47 in deficit water years. The normal minimum flow out of Cougar is 400 cfs all year, so the rules at Cougar are modified to increase the minimum outflows in June through the end of September to be 598.94 cfs in most years, 586.47 cfs in deficit years.

The diversion flow contributions required from Hills Creek are added to the 400 cfs normal minimum at HCR, but they are also added to the flow contributions at Lookout Point because LOP is downstream of HCR. Similarly, the flow contributions at Green Peter are added to the flow contributions at Foster, since Foster is downstream of GPR.

Some of the future demand cannot be met by reservoirs with hydropower. The demand for stored water at Goshen can only be satisfied from Cottage Grove or Dorena releases, neither of which has hydropower. Demand for stored water at Monroe can only be met by Fern Ridge, which is not a hydropower project.

Although Big Cliff and Dexter produce hydropower, they are reregulating projects whose pool levels fluctuate only a small amount. On average over about a day, the projects pass all the water they receive. These two projects are not modeled with rules in ResSim, but instead just pass the daily inflow. Their outflows still contribute to hydropower production, but they do not have a storage content to contribute a share of stored water used to meet demand.

Table C.1.7 Stored Flow Contributions from Upstream Projects for Future Municipal Demands.

Municipal Flow Projected Need	Hydropower Projects that can be used to meet need* (Storage above inactive when full, in acre feet.)	Relative Storage Proportion = Project Storage / Total Storage of all Projects used to meet demand	Stored Flow Release In Most Water Yrs, June-Sept. (cfs)	Stored Flow Release In Deficit Water Yrs, June-September (For Worst Case Hydropower, no reduction to Muni.)
Albany, 57.90 cfs	HCR: 194,600 ac-ft	0.297	17.18	17.18
	LOP: 324,200 ac-ft	0.495	28.63	28.63
	CGR: 136,800 ac-ft	0.209	12.08	12.08
Goshen*, 3.68	COT: 28,661 ac-ft	0.307	1.13	1.13
	DOR: 64,745 ac-ft	0.693	2.55	2.55
Harrisburg, 1.50 cfs	HCR: 194,600 ac-ft	0.297	0.44	0.44
	LOP: 324,200 ac-ft	0.495	0.74	0.74
	CGR: 136,800 ac-ft	0.209	0.31	0.31
Jasper, 1.45 cfs	HCR: 194,600 ac-ft	0.375	0.54	0.54
	LOP: 324,200 ac-ft	0.625	0.90	0.90
Jefferson, 0.82 cfs	DET: 281,600 ac-ft	0.506	0.42	0.42
	GPR: 249,900 ac-ft	0.449	0.37	0.37
	FOS: 24,800 ac-ft	0.045	0.04	0.04
Mehama, 94.11 cfs	DET: 281,600 ac0ft	1.000	94.11	94.11
Monroe*, 0.99 cfs	FRN: 94,498 ac-ft	1.000	0.99	0.99
Salem, 35.66 cfs	DET: 281,600 ac-ft	1.000	35.66	35.66
Vida, 105.19 cfs	CGR: 136,800 ac-ft	1.000	105.19	105.19
Waterloo, 7.51 cfs	GPR:249,900 ac-ft	0.910	6.83	6.83
	FOS: 24,800 ac-ft	0.090	0.68	0.68
Wilsonville plus Oregon City, 240.47 cfs	HCR: 194,600 ac-ft	0.161	38.61	38.61
	LOP: 324,200 ac-ft	0.268	64.33	64.33
	CGR: 136,800 ac-ft	0.113	27.14	27.14
	GPR:249,900 ac-ft	0.206	49.59	49.59
	FOS: 24,800 ac-ft	0.020	4.92	4.92
	DET: 281,600 ac-ft	0.232	55.88	55.88

*Some projected needs can only be met with non-hydropower projects.

Table C.1.8 Stored Flow Contributions from Upstream Projects, for Future Industrial Demands.

Industrial Flow Projected Need	Hydropower Projects that can be used to meet need (Storage above inactive when full, in acre feet.)	Relative Storage Proportion = Project Storage / Total Storage of all Projects used	Stored Flow Release In Most Water Yrs, June-Sept. (cfs)	Stored Flow Release In Deficit Water Yrs, Jun – Sept.
Albany, 92.87 cfs	HCR: 194,600 ac-ft	0.297	27.57	21.23
	LOP: 324,200 ac-ft	0.495	45.92	35.36
	CGR: 136,800 ac-ft	0.209	19.38	14.92
Harrisburg, 108.35 cfs	HCR: 194,600 ac-ft	0.297	32.16	24.75
	LOP: 324,200 ac-ft	0.495	53.58	41.25
	CGR: 136,800 ac-ft	0.209	22.61	17.41
Salem, 108.35 cfs (Includes Wilsonville and Oregon City Industrial)	HCR: 194,600 ac-ft	0.161	17.40	13.40
	LOP: 324,200 ac-ft	0.268	28.98	22.32
	CGR: 136,800 ac-ft	0.113	12.23	9.42
	GPR:249,900 ac-ft	0.206	22.34	17.20
	FOS: 24,800 ac-ft	0.020	2.22	1.71
	DET: 281,600 ac-ft	0.232	25.18	19.39

Once these changes were made to the model, this revised set of operations was used for a new simulation referred to as the Worst-Case Hydropower Analysis. The results from this new simulation were then used by BPA and the Corps to determine the system wide pricing for the cost of stored water. Table C.1.9 below lists the particulars of this simulation.

Table C.1.9 Worst-Case Hydropower Analysis Particulars for ResSim Simulation.

ResSim Version	HEC-ResSim 3.1 RC3 Build 101	**Watershed**	Willamette3
Network	Diversions in Early Imp Network		
Configuration	Existing	**Alternative**	HydroM-I
Inflow File Name	Daily Series – 13Apr2011.dss		
Rule Curve File	Willamette_Rule_Curves.dss		
External Variables File	year_classifications.dss		
Simulation Name	Meet-M-I-Hydro-042513		
Simulation Start **Simulation Lookback**	04 Oct 1935 at 2400 01 Oct 1935 at 2400	**Simulation Ending**	31 Dec 2008 at 2400

Project	**Operation Set Name**	**Lookback Elevation**	**Lookback Flows (cfs)**
Detroit	DET Hydro meet M and I	Rule Curve	Power Plant 1573.0, Spillway and ROs 0.0
Big Cliff	Early Imp	1193.0 ft	Power Plant 1573.0, Spillway 0.0
Green Peter	GPR Hydro meet M and I	Rule Curve	Power Plant 1500.0, Spillway and RO 0.0
Foster	FOS hydro meet M and I	Rule Curve	Power Plant 1500.0, Spillway 0.0
Cougar	CGR Hydro meet M and I	Rule Curve	Power Plant 400.0, Spillway and RO 0.0
Blue River	New Early Imp	Rule Curve	RO 50.0,Spillway 0.0
Hills Creek	HCR All Hydro Storage	Rule Curve	Power Plant 1200.0, Spillway and ROs 0.0
Lookout Point	LOP Hydro meet M and I	Rule Curve	Power Plant 1200.0, Spillway and ROs 0.0
Dexter	Early Imp	693.0 ft	Power Plant 1200.0, Spillway 0.0
Fall Creek	Early Imp	Rule Curve	RO 200.0, Spillway 0.0
Cottage Grove	COT meet M and I	Rule Curve	RO 50.0, Spillway 0.0
Dorena	DOR meet M and I	Rule Curve	RO 100.0, Spillway 0.0
Fern Ridge	FRN meet M and I	Rule Curve	RO 30.0, Spillway and Sluice Gate 0.0

C.1.6. Study Results

Results of two study sets are documented in this section: the use of 499 ac-ft of stored water at Cottage Grove and Dorena (CF-499-ac-ft-041513), and the use of stored water to meet the 2050 projected M&I demand (Meet-M-I-Hydro-042513). These results are presented in a summary form in terms of comparisons between each of these model runs and the Early Implementation Baseline. The comparisons are made by post-processing the ResSim output using templates created for the COP analyses and documented in the Model Documentation Report referenced earlier. All results are compared to the equivalent data from the reference baseline set. This allows for relative comparisons between current operations and proposed operations.

The overall changes to the system can be summarized by showing the average pool elevation throughout the year at each project. The daily average pool elevation for the simulations are obtained by finding the average 1 January elevation for all modeled year, the average 2 January elevation for all modeled years, and so on, until a daily average pool elevation plot is obtained and plotted against the project rule curve for reference.

C.1.6.1. 499 ac-ft Analysis Results (From Step 2)

This analysis uses the Early Implementation operation sets in ResSim, except for at Cottage Grove and Dorena, where additional flow is released to cover the diversion at Goshen. As shown in Table A-5, the total additional release from these projects is ~ 2cfs more than current operations. This amount is so small that on average, no changes are visible in project pool elevations for the whole system (Figure C.1.2). Table C.1.10 and Table C.1.11 show how little the outflows and pool elevations for both reservoirs change compared to the current operations.

Figure C.1.3 shows two graphs of non-exceedance values for Dorena reservoir with the 499 ac-ft analysis case compared to the Early Implementation Baseline results. These non-exceedance values show the various percentages for every day of the year at which storage values at Dorena are not exceeded. For example, all Dorena reservoir storage values for day “D” for all 73 years of the Period of Record are pulled from the results and sorted from low to high. The storage value at the midpoint of these 73 sorted numbers for day “D” is the 50% non-exceedance storage, meaning that half the time this storage value is NOT exceeded on this particular day – half the storage values on day “D” are less than or equal to this value, half are greater than this value. The 5% non-exceedance value on day “D” means 5% of these sorted values are equal to or less than this, and all the rest are greater. The non-exceedance values are calculated for every day of the year for both analysis cases.

The upper graph of Figure C.1.3 shows that the 5% storage values at Dorena are never as low as the minimum conservation zone for the entire conservation season, for both the Early Implementation Baseline and the 499 ac-ft case. The lower graph in the figure is a close-up of the 5% curves for September through October with -40 acre foot error bars added to the 499 ac-ft analysis case. The error bars on the 5% non-exceedance curve are also never as low as the minimum conservation zone. The magnitude of the error bars, 40 ac-ft., was determined by adding the additional releases for Creswell to Dorena’s minimum outflow, accounting for a gage accuracy of 10 percent (the gage could read 10 percent low, so 10 percent additional flow could be needed), for a possible maximum additional outflow of 19.206 cfs, which is 38 acre feet of storage a day. This means that Dorena alone has enough stored water to meet the 499 ac-ft of additional outflow for June through September at least 95% of the time.

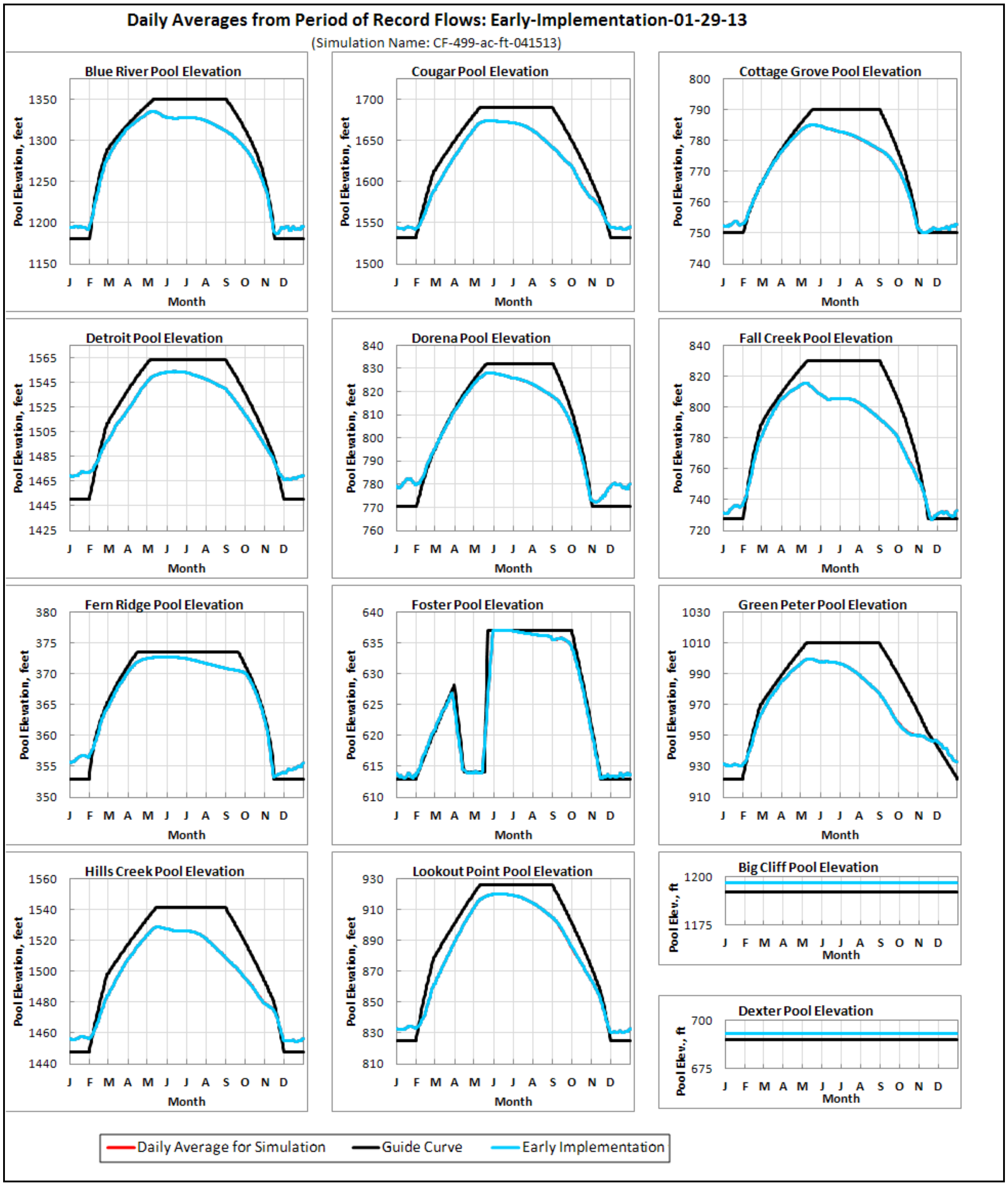

Figure C.1.2 Comparison of Daily Average Reservoir Elevations.

Note: Each graph shows the average pool elevation of a project in the 499 ac-ft Analysis (red, although not visible because it is identical to the blue and plots underneath it) to the average pool elevation of a project in the Early Implementation Baseline (in blue). The black lines are the project Rule Curves. Red is not visible as there was not enough change to see the difference between the baseline and simulation.

Table C.1.10 Post-Processed ResSim Model Results for Cottage Grove Reservoir in the 499 ac-ft Analysis.

Cottage Grove Project Summary									Simulation: CF-499-ac-ft-041513							
Non-Exceedance values for average flows through project outlets, average reservoir elevations, and number of days in a period that minimum tributary flows not met.			Non-Exceedance Values for 73 Water Years (Conditional formatting compares to Baseline counterpart.)						Median Non-Exceedance Values by Water Year Type							
			Early Implementation Baseline POR			Simulation POR			Early Imp. Baseline by WY Type				Simulation by WY Type			
Average Outflow, cfs			5%	50%	95%	5%	50%	95%	Abundant	Adequate	Insufficient	Deficit	Abundant	Adequate	Insufficient	Deficit
October			30	250	370	30	260	370	260	260	140	240	260	260	140	240
November			40	270	670	40	270	670	310	240	230	160	310	240	230	160
December			90	440	1140	90	440	1140	490	330	620	330	490	330	620	330
January			120	550	1120	120	550	1120	650	590	550	360	650	590	550	360
February			100	390	800	100	390	800	530	370	240	130	530	370	240	130
March			90	300	710	90	300	710	410	300	140	120	410	300	140	120
April			110	190	440	110	190	440	230	180	170	140	230	180	170	140
May			80	160	340	80	160	340	140	150	180	160	140	150	180	160
June			80	110	220	80	110	220	110	100	110	100	110	100	110	100
July			50	50	80	50	50	80	50	50	50	50	50	50	50	50
August			50	50	90	50	50	90	60	60	50	50	60	60	50	50
September			40	120	210	40	110	210	160	80	90	50	160	70	90	50
Water Year Statistics			160	250	400	160	250	400	300	250	200	170	300	250	200	170
Average Regulating Outlet Flow, cfs																
October			30	250	370	30	260	370	260	260	140	240	260	260	140	240
November			40	270	670	40	270	670	310	240	230	160	310	240	230	160
December			90	440	1140	90	440	1140	490	330	620	330	490	330	620	330
January			120	550	1120	120	550	1120	650	590	550	360	650	590	550	360
February			100	390	800	100	390	800	530	370	240	130	530	370	240	130
March			90	300	710	90	300	710	410	300	140	120	410	300	140	120
April			110	190	440	110	190	440	230	180	170	140	230	180	170	140
May			80	160	340	80	160	340	140	150	180	160	140	150	180	160
June			80	110	220	80	110	220	110	100	110	100	110	100	110	100
July			50	50	80	50	50	80	50	50	50	50	50	50	50	50
August			50	50	90	50	50	90	60	60	50	50	60	60	50	50
September			40	120	210	40	110	210	160	80	90	50	160	70	90	50
Water Year Statistics			160	250	400	160	250	400	300	250	200	170	300	250	200	170
Average Spillway Flow, cfs																
October			0	0	0	0	0	0	0	0	0	0	0	0	0	0
November			0	0	0	0	0	0	0	0	0	0	0	0	0	0
December			0	0	0	0	0	0	0	0	0	0	0	0	0	0
January			0	0	0	0	0	0	0	0	0	0	0	0	0	0
February			0	0	0	0	0	0	0	0	0	0	0	0	0	0
March			0	0	0	0	0	0	0	0	0	0	0	0	0	0
April			0	0	0	0	0	0	0	0	0	0	0	0	0	0
May			0	0	0	0	0	0	0	0	0	0	0	0	0	0
June			0	0	0	0	0	0	0	0	0	0	0	0	0	0
July			0	0	0	0	0	0	0	0	0	0	0	0	0	0
August			0	0	0	0	0	0	0	0	0	0	0	0	0	0
September			0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Year Statistics			0	0	0	0	0	0	0	0	0	0	0	0	0	0
Days Tributary Flows Not Met																
01 October - 31 December	50	Instream	0	0	35	0	0	35	0	0	1	0	0	0	1	0
01 - 31 January	50	Instream	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01 February - 30 June	75	Instream	0	0	1	0	0	1	0	0	1	0	0	0	0	0
01 July - 30 September	50	Instream	0	0	10	0	0	12	0	0	0	0	0	0	0	0
Water Year Statistics			0	1	42	0	1	43	1	0	1	20	1	0	1	20
Average Reservoir Elevation, ft																
October	Rule Curve, ft.:	765	750	764	764	750	764	764	764	764	760	764	764	764	760	764
November	Rule Curve, ft.:	750	750	750	754	750	750	754	750	750	750	750	750	750	750	750
December	Rule Curve, ft.:	750	750	750	760	750	750	760	750	750	752	750	750	750	752	750
January	Rule Curve, ft.:	750	750	750	761	750	750	761	751	751	750	750	751	751	750	750
February	Rule Curve, ft.:	759	758	759	761	758	759	761	759	759	760	759	759	759	760	759
March	Rule Curve, ft.:	772	768	772	772	768	772	772	772	772	772	770	772	772	772	770
April	Rule Curve, ft.:	781	773	781	782	773	781	782	782	781	780	774	782	781	780	774
May	Rule Curve, ft.:	789	774	787	789	774	787	789	789	784	783	777	789	784	783	777
June	Rule Curve, ft.:	790	769	787	790	769	787	790	789	783	781	771	789	783	781	771
July	Rule Curve, ft.:	790	762	786	790	762	786	790	788	780	781	767	788	780	781	767
August	Rule Curve, ft.:	790	757	784	788	757	783	788	786	778	778	762	786	777	778	762
September	Rule Curve, ft.:	783	751	780	783	751	779	783	781	772	772	759	781	772	772	759
Water Year Statistics			761	771	773	761	771	773	772	769	768	763	772	769	768	763

Simulation value compared to Baseline:	70% and less	70% to 80%	80% to 90%	90% to 110%	110% to 120%	120% to 130%	130% and more

Non-Exceedance Value Example for Early Imp. Run, Average Reservoir Outflow for October:
Total project outflow is 30 cfs or less in October 5% of the time.
Total project outflow is 250 cfs or less in October 50% of the time.
Total project outflow is 370 cfs or less in October 95% of the time.

Note: The additional flow release from Cottage Grove to supply the water being diverted for the City of Creswell's request is so small that there are almost no changes from the current operations. The Cottage Grove outflows and pool elevations for current operations are in the Early Implementation columns, and 499 ac-ft analysis outflows and pool elevations are in the Simulation columns in the table.

Table C.1.11 Post-Processed ResSim Model Results for Dorena Reservoir in the 499 ac-ft Analysis.

Dorena Project Summary			Simulation: CF-499-ac-ft-041513													
Non-Exceedance Values for Average Flows and Days Minimum Tributary Flows not Met.			Non-Exceedance Values for 73 Water Years Conditional formatting compares to Baseline counterpart						Median Non-Exceedance Values by Water Year Type							
			Early Implementation Baseline POR			Simulation POR			Early Imp. Baseline by WY Type				Simulation by WY Type			
Average Outflow			5%	50%	95%	5%	50%	95%	Abundant	Adequate	Insufficient	Deficit	Abundant	Adequate	Insufficient	Deficit
October			190	610	990	190	610	990	620	630	550	590	620	630	550	590
November			100	760	1950	100	760	1950	990	650	560	500	990	650	560	500
December			280	1290	3110	280	1290	3110	1440	1090	1830	860	1440	1090	1830	860
January			290	1510	2990	290	1510	2990	1860	1560	1530	900	1860	1560	1530	900
February			240	1090	2170	240	1090	2170	1310	1150	1040	330	1310	1150	1040	330
March			250	910	1850	250	910	1850	1130	810	510	280	1130	810	510	280
April			320	670	1420	320	670	1420	880	650	380	430	880	650	380	430
May			250	450	1160	250	450	1160	610	340	400	400	610	340	400	400
June			220	310	740	220	310	740	310	360	320	270	310	360	320	280
July			100	110	190	100	120	190	100	130	120	170	110	130	120	170
August			100	140	200	100	140	200	130	170	160	170	130	170	170	170
September			110	330	500	110	330	500	410	210	200	190	410	210	200	190
Water Year Statistics			420	720	1090	420	720	1090	810	690	630	440	810	690	630	440
Average Regulating Outlet Flow																
October			190	610	990	190	610	990	620	630	550	590	620	630	550	590
November			100	760	1950	100	760	1950	990	650	560	500	990	650	560	500
December			280	1290	3110	280	1290	3110	1440	1090	1830	860	1440	1090	1830	860
January			290	1510	2920	290	1510	2920	1860	1560	1530	900	1860	1560	1530	900
February			240	1090	2170	240	1090	2170	1310	1150	1040	330	1310	1150	1040	330
March			250	910	1850	250	910	1850	1130	810	510	280	1130	810	510	280
April			320	670	1420	320	670	1420	880	650	380	430	880	650	380	430
May			250	450	1160	250	450	1160	610	340	400	400	610	340	400	400
June			220	310	740	220	310	740	310	360	320	270	310	360	320	280
July			100	110	190	100	120	190	100	130	120	170	110	130	120	170
August			100	140	200	100	140	200	130	170	160	170	130	170	170	170
September			110	330	500	110	330	500	410	210	200	190	410	210	200	190
Water Year Statistics			420	720	1090	420	720	1090	810	690	630	440	810	690	630	440
Average Spillway Flow																
October			0	0	0	0	0	0	0	0	0	0	0	0	0	0
November			0	0	0	0	0	0	0	0	0	0	0	0	0	0
December			0	0	0	0	0	0	0	0	0	0	0	0	0	0
January			0	0	0	0	0	0	0	0	0	0	0	0	0	0
February			0	0	0	0	0	0	0	0	0	0	0	0	0	0
March			0	0	0	0	0	0	0	0	0	0	0	0	0	0
April			0	0	0	0	0	0	0	0	0	0	0	0	0	0
May			0	0	0	0	0	0	0	0	0	0	0	0	0	0
June			0	0	0	0	0	0	0	0	0	0	0	0	0	0
July			0	0	0	0	0	0	0	0	0	0	0	0	0	0
August			0	0	0	0	0	0	0	0	0	0	0	0	0	0
September			0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Year Statistics			0	0	10	0	0	10	0	0	0	0	0	0	0	0
Days Tributary Flows Not Met																
Period	Target	Purpose														
01 October - 31 December	100	Instream	0	0	22	0	0	22	0	0	0	0	0	0	0	0
01 - 31 January	100	Instream	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01 February - 30 June	190	Instream	0	0	1	0	0	1	0	0	1	0	0	0	0	0
01 July - 30 September	100	Instream	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Year Statistics			0	0	22	0	0	22	0	0	1	0	0	0	1	0
Average Reservoir Elevation		Rule Curve														
October		794	777	793	793	777	793	793	793	793	791	792	793	793	791	792
November		771	771	772	784	771	772	784	773	772	773	771	773	772	773	771
December		771	771	776	804	771	776	804	776	775	777	773	776	775	777	773
January		771	771	777	799	771	777	799	780	778	776	772	780	778	776	772
February		784	781	786	795	781	786	795	786	785	785	783	786	785	785	783
March		804	799	804	806	799	804	806	805	804	804	802	805	804	804	802
April		819	811	819	820	811	819	820	819	819	819	816	819	819	819	816
May		830	817	829	830	817	829	830	830	825	826	821	830	825	826	821
June		832	810	831	832	810	831	832	832	826	830	815	832	826	830	815
July		832	802	829	832	801	829	832	831	824	825	815	831	824	825	815
August		832	792	826	830	792	826	830	828	821	818	810	828	821	818	810
September		822	785	819	821	785	819	821	820	814	809	806	820	814	809	806
Water Year Statistics			792	805	809	792	805	809	806	803	802	796	806	803	802	796

Simulation value compared to Baseline:	70% and less	70% to 80%	80% to 90%	90% to 110%	110% to 120%	120% to 130%	130% and more

Non-Exceedance Value Example for Early Imp. Run, Average Reservoir Outflow for October:
Total project outflow is 190 cfs or less in October 5% of the time.
Total project outflow is 610 cfs or less in October 50% of the time.
Total project outflow is 990 cfs or less in October 95% of the time.

Note: The additional flow release from Dorena to supply the water being diverted for the City of Creswell's request is so small that there are almost no changes from the current operations. The Dorena outflows and pool elevations for current operations are in the Early Implementation columns, and 499 ac-ft analysis outflows and pool elevations are in the Simulation columns in the table.

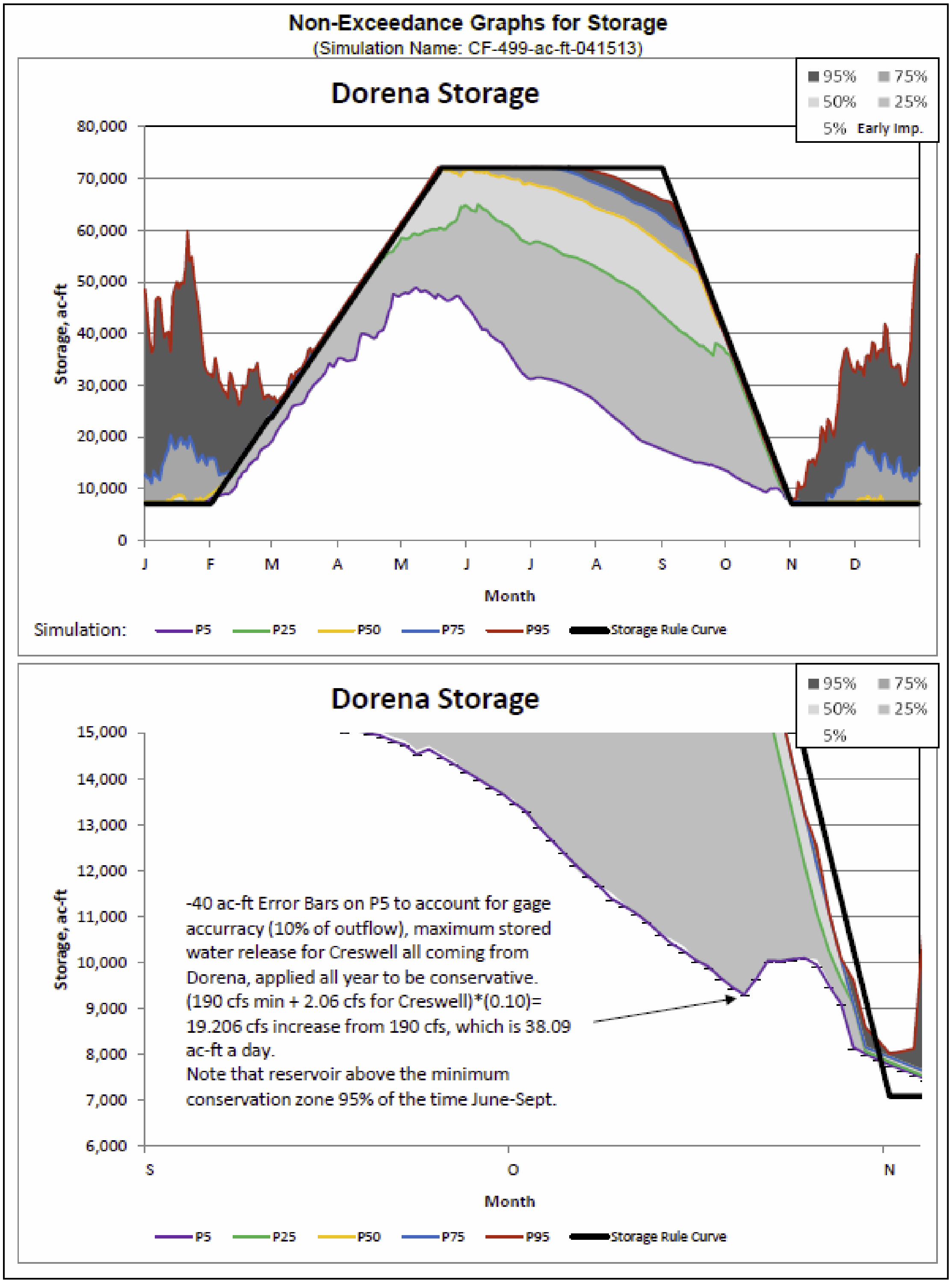

Figure C.1.3 Storage Availability at Dorena Reservoir.

Note: Graphs show the non-exceedance levels for 5%, 25%, 50%, 75%, and 95% for the Early Implementation Baseline analysis (in gray scale areas) and the 499 ac-ft analysis, color lines. The 5% non-exceedance level in the upper graph is never as low as the minimum conservation zone in the conservation season for either run. The 5% non-exceedance level in the lower graph is a close-up of September and October, with 40 ac-ft error bars about the 499 ac-ft analysis 5% non-exceedance (purple line), also never going as low as the minimum conservation zone during this period.

C.1.6.2. Projected 2050 M&I Demand Analysis Results (From Step 3)

The worst case hydropower analysis has all the projected 2050 municipal and industrial demands input as diversions in the model, as well as specified releases at hydropower projects (when possible) to cover the amount diverted. The average effect on reservoir elevations is shown in Figure C.1.3, with the largest effects at Cougar, Detroit, Hills Creek, and Lookout Point. Changes at other projects, on average, are less noticeable in these graphs.

The non-exceedance graphs for the four projects with the most change are shown in four figures following the average graphs. In Figure C.1.4 to Figure C.1.7, the gray-scale areas represent the various percentile non-exceedances of the pool elevations associated with the Early Implementation Baseline, and the colored lines represent the same percentile non-exceedances for the Worst Case Hydropower Analysis. As an example, the June 1 value of the purple line at Detroit is at approximately 1510 ft. This P5 value means that the pool elevation of Detroit is 1510 or less at Detroit five percent of the time. The June 1 green line (P25) at Detroit is at about elevation 1550 ft, meaning that the Detroit pool elevation is 1550 ft or less on June 1 for 25 percent of the time.

The four non-exceedance graphs for Detroit, Cougar, Hills Creek, and Lookout Point indicate that the winter pool elevations and the refill period are not affected by the diversions for M&I or the increased minimum project releases, but that the months June through October are likely to have lower pool elevations than in the Early Implementation Baseline. Lower elevations mean that more water is being let out of the projects at the beginning of this period. The values in Table C.1.12, for Detroit, show the average flow at Detroit is greater than the baseline in June through September, but less than the baseline in the fall and winter months. Results at Cougar, Hills Creek, and Lookout Point are similar. Table C.1.13 indicates there are more days of BiOp flow minimums not met in the worst case hydropower analysis than in the Early Implementation Baseline.

The worst case hydropower analysis is used for developing the system wide price of stored water used for M&I. The results presented for this case are meant to show the broad generalizations that can be summarized by the figures and tables presented here.

The hydropower analysis is performed using the simulation results from the ResSim runs. In this process, the daily values for all project flows through the turbines and total reservoir outflows are binned into the same fourteen periods used by BPA in their Hydsim program, which uses monthly averages, except for April and August, which are divided into two periods. The 73 years of fourteen period average values for flows are then provided to BPA to process through Hydsim, which then computes the power that was generated for each period of every year. The power results are then processed by the Corps to determine impacts to hydropower. In this way, the dollar difference between power produced from current operations (Early Implementation) and using specific projects to meet future M&I demand (Worst Case Hydropower) can be determined.

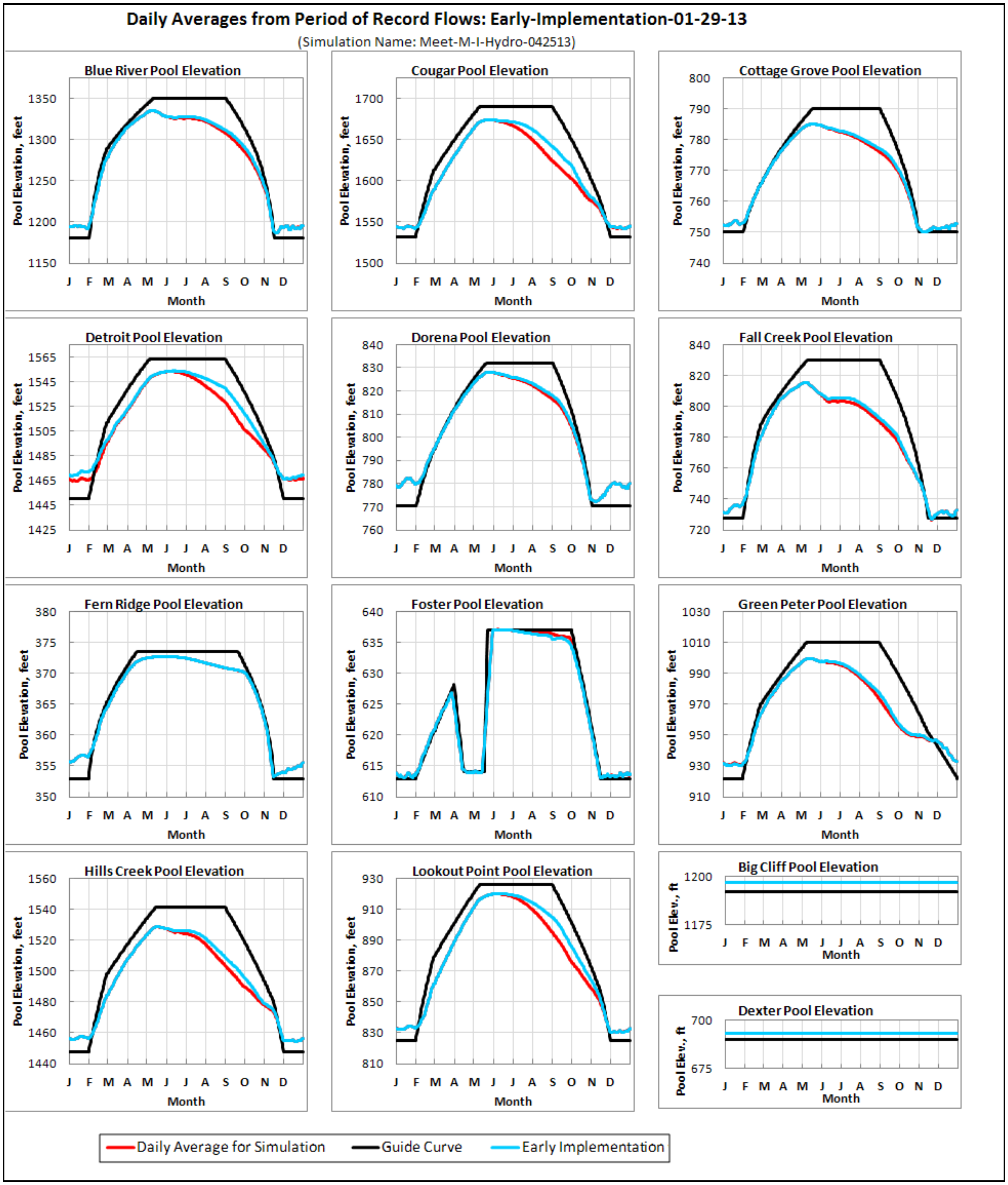

Figure C.1.3 Comparison of Daily Average Reservoir Elevations of the Worst Case Hydropower Analysis to the Early Implementation Analysis.

Note: Each graph shows the average pool elevation of a project in the Worst Case Hydropower Analysis (red, although not visible because it is identical to the blue and plots underneath it) to the average pool elevation of a project in the Early Implementation Baseline (in blue). The black lines are the project Rule Curves.

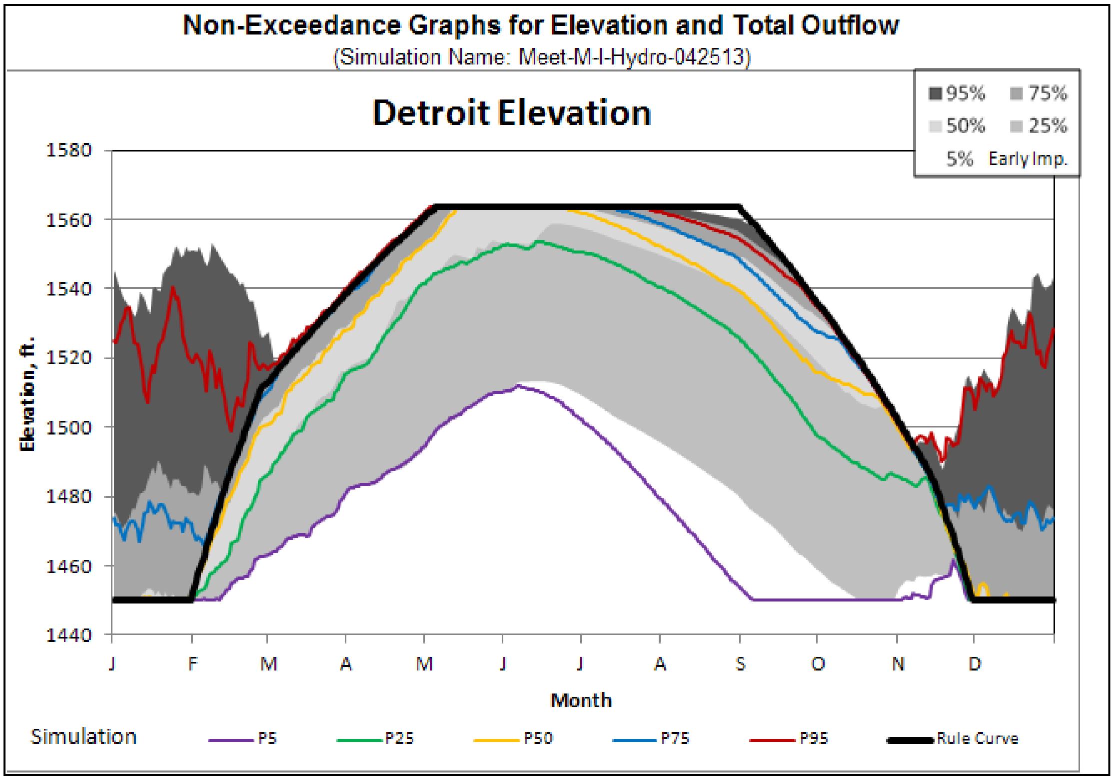

Figure C.1.4 Comparison of Average Elevation at DET between the Early Implementation Baseline (gray scale areas) to the Worst Case Hydropower Analysis (colored lines).

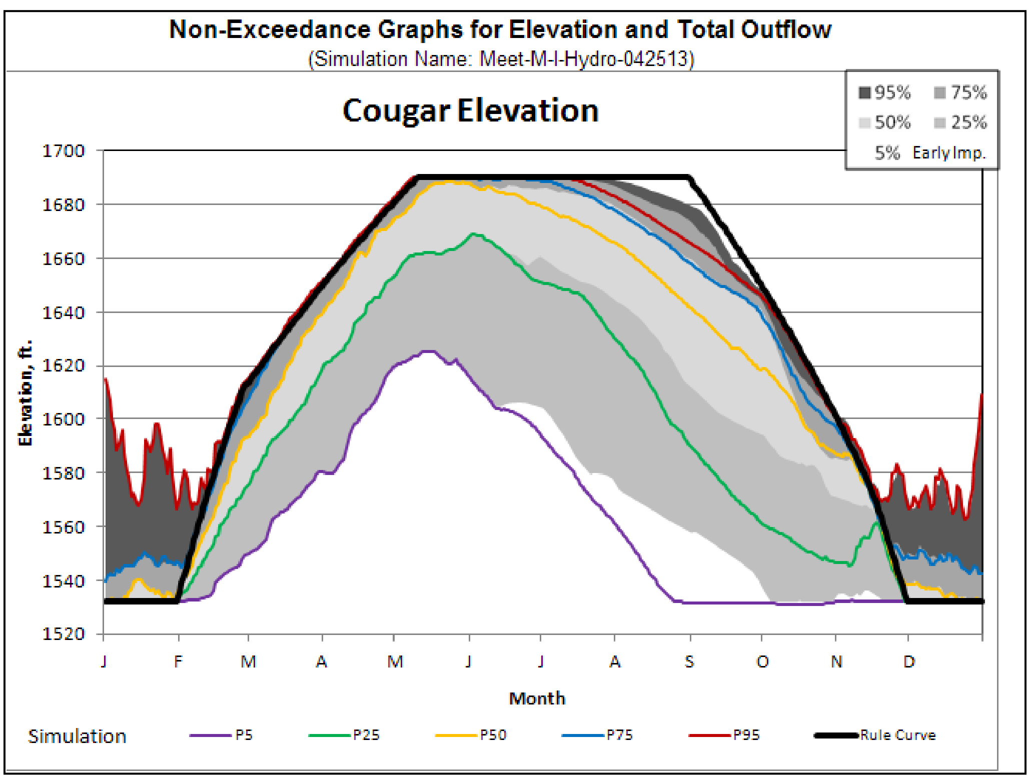

Figure C.1.5 Comparison of Average Elevation at CGR between the Early Implementation Baseline (gray scale areas) to the Worst Case Hydropower Analysis (colored lines).

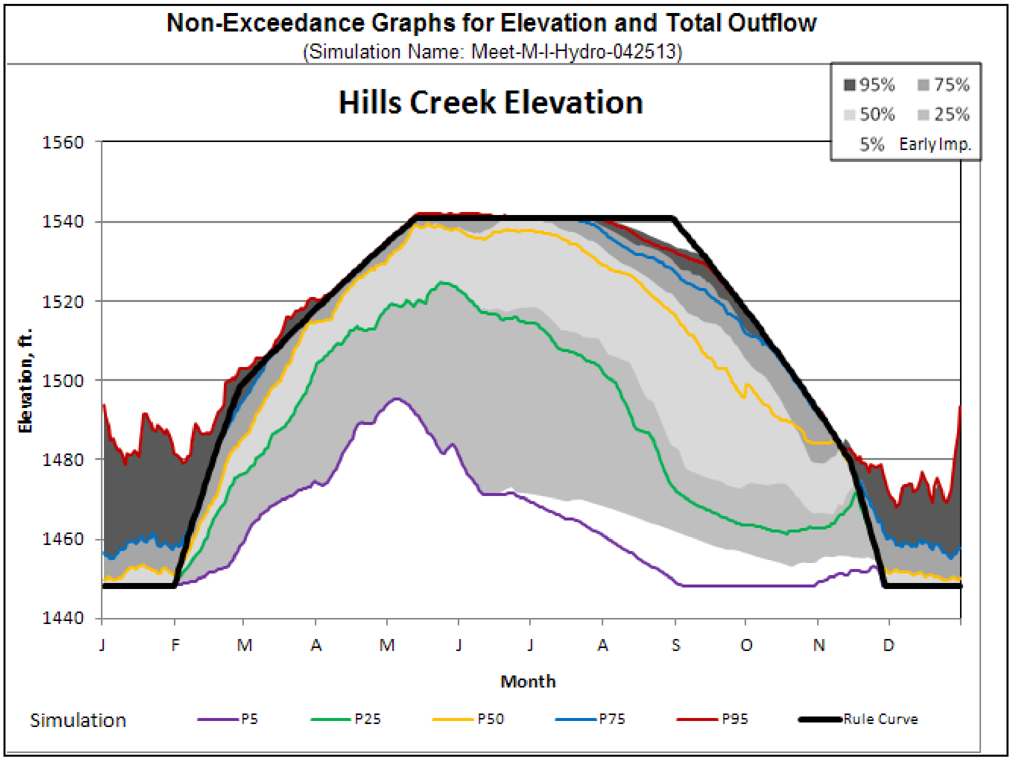

Figure C.1.6 Comparison of Average Elevation at HCR between the Early Implementation Baseline (gray scale areas) to the Worst Case Hydropower Analysis (colored lines).

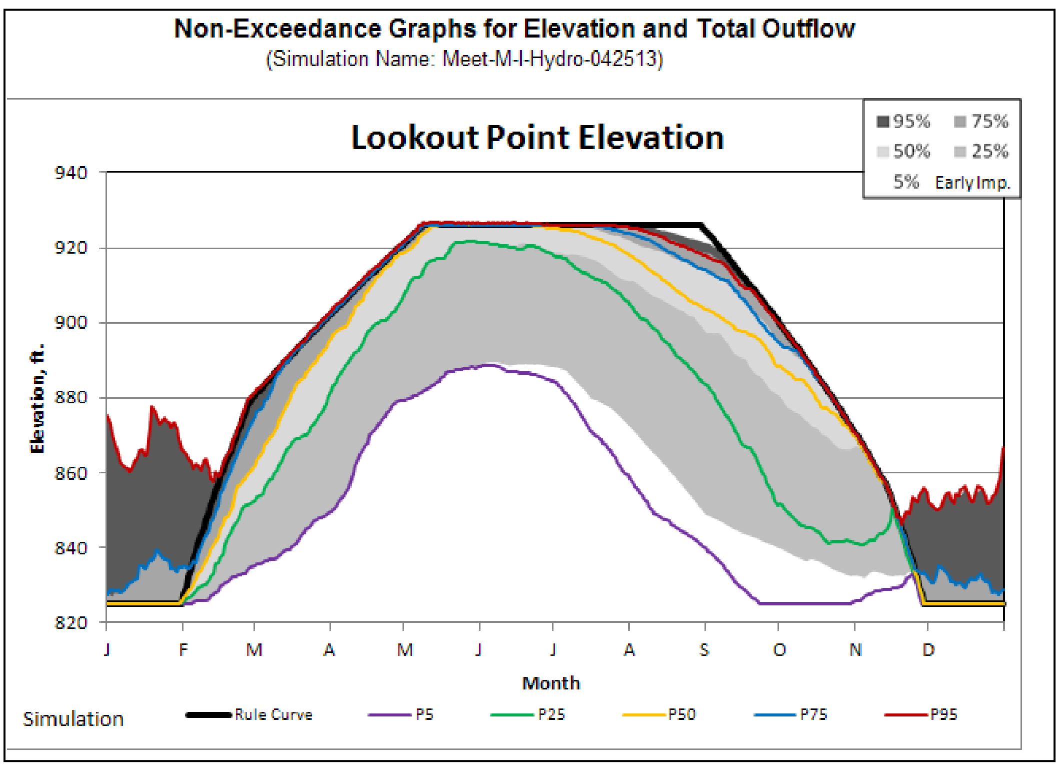

Figure C.1.7 Comparison of Average Elevation at LOP between the Early Implementation Baseline (gray scale areas) to the Worst Case Hydropower Analysis (colored lines).

Table C.1.12 Post-Processed ResSim Model Results for Detroit Reservoir, Worst Case Hydropower Analysis.

Detroit Project Summary							Simulation: Meet-M-I-Hydro-042513							
Exceedance Values for Average Flows and Number of Days Tributary Flows Not Met.	Exceedance Values for 73 Water Years (Conditional formatting compares to Baseline counterpart)						Exceedance Values by Water Year Type							
	Early Implementation Baseline POR			Simulation POR			Early Imp. Baseline by WY Type				Simulation by WY Type			
Average Outflow	5%	50%	95%	5%	50%	95%	Abundant	Adequate	Insufficient	Deficit	Abundant	Adequate	Insufficient	Deficit
October	900	2110	3360	650	1460	2700	2180	1880	1820	1740	1690	1270	1270	1270
November	1920	3430	4930	1690	3370	4960	3710	3280	3090	2850	3570	3030	3120	2670
December	1370	3350	5200	1370	3350	5610	3540	2610	3550	2750	3640	2610	3550	2720
January	1240	3420	5270	1270	3290	6300	3540	3530	3090	2270	3480	3530	3020	2270
February	980	1660	5610	980	1550	5040	1910	1510	2060	1000	1860	1240	2100	1000
March	1260	1270	3190	1260	1280	3200	1610	1270	1270	1260	1610	1260	1260	1260
April	1500	1570	2850	1500	1570	2850	1850	1570	1570	1500	1810	1570	1540	1500
May	1500	2180	4210	1500	2090	4210	2720	1570	1570	1500	2720	1570	1530	1500
June	1200	1640	3750	1480	1660	3750	2090	1490	1270	1200	2090	1490	1480	1480
July	1090	1160	1600	1380	1380	1690	1180	1160	1160	1090	1380	1380	1380	1380
August	1000	1070	1090	1250	1280	1300	1070	1070	1070	1000	1280	1280	1280	1280
September	1150	1570	2160	760	1780	1870	1610	1570	1570	1500	1780	1780	1780	1420
Water Year Statistics	1570	2150	3060	1600	2160	3050	2340	2080	1900	1690	2360	2130	1880	1700
Average Upper Regulating Outlet Flow														
October	0	120	460	0	280	410	120	170	380	20	260	370	190	240
November	0	20	360	0	30	510	10	20	30	0	20	40	50	10
December	0	20	540	0	30	1580	30	20	20	10	30	30	40	10
January	0	20	200	0	30	1320	20	20	20	10	30	20	10	10
February	0	0	400	0	0	1450	0	0	0	0	0	0	0	0
March	0	0	430	0	0	420	0	0	0	0	0	0	0	0
April	0	0	0	0	0	0	0	0	0	0	0	0	0	0
May	0	0	0	0	0	0	0	0	0	0	0	0	0	0
June	0	0	0	0	0	0	0	0	0	0	0	0	0	0
July	0	0	0	0	0	0	0	0	0	0	0	0	0	0
August	0	0	0	0	0	0	0	0	0	0	0	0	0	0
September	0	390	430	0	460	480	260	410	410	390	460	460	460	0
Water Year Statistics	10	70	140	20	90	310	70	70	70	30	90	100	80	30
Average Turbine Flow														
October	880	2010	3080	650	1130	2530	2170	1520	1430	1320	1370	870	1170	890
November	1890	3350	4740	1680	3120	4600	3610	3280	3090	2700	3510	3030	3120	2630
December	1370	3230	4590	1370	3340	4640	3510	2570	3510	2730	3410	2570	3510	2700
January	1240	3180	4690	1270	3060	4770	3460	3490	3070	2260	3460	3500	3010	2260
February	980	1660	4410	980	1540	3680	1860	1510	2060	1000	1800	1230	2100	1000
March	1260	1270	2770	1260	1280	2790	1610	1270	1270	1260	1610	1260	1260	1260
April	1120	1500	1820	1090	1500	1790	1420	1520	1570	1500	1440	1550	1540	1500
May	580	1140	2290	580	1140	2290	1110	760	1560	1500	1110	800	1530	1500
June	480	820	1700	560	830	1700	770	670	740	1200	780	620	860	1480
July	560	590	1160	660	690	1380	570	560	560	1090	670	690	960	1380
August	610	610	1070	730	880	1280	610	610	620	1000	740	1080	1150	1280
September	940	1150	2110	760	1320	1510	1170	1170	1150	1110	1290	1320	1320	1320
Water Year Statistics	1290	1750	2320	1320	1740	2140	1850	1710	1640	1620	1750	1690	1650	1670
Average Spillway Flow														
October	0	0	0	0	0	0	0	0	0	0	0	0	0	0
November	0	0	0	0	0	0	0	0	0	0	0	0	0	0
December	0	0	190	0	0	180	0	0	0	0	0	0	0	0
January	0	0	820	0	0	430	0	0	0	0	0	0	0	0
February	0	0	940	0	0	330	0	0	0	0	0	0	0	0
March	0	0	0	0	0	0	0	0	0	0	0	0	0	0
April	0	270	1020	0	260	1020	600	70	0	0	470	70	0	0
May	0	1360	2070	0	1320	2070	1700	990	0	0	1690	990	0	0
June	0	1020	1990	0	1050	1990	1310	940	540	0	1310	980	630	0
July	0	610	850	0	720	890	620	610	600	0	720	720	420	0
August	0	470	470	0	390	560	470	470	460	0	560	200	0	0
September	0	130	260	0	0	280	190	80	20	0	110	0	0	0
Water Year Statistics	0	350	600	0	340	530	420	280	140	0	410	260	130	0

Simulation value compared to Baseline:							
	70% and less	70% to 80%	80% to 90%	90% to 110%	110% to 120%	120% to 130%	130% and more

Exceedance Value Example for Early Imp. Run, Average Reservoir Outflow for October:
Total project outflow is 900 cfs or less in October 5% of the time.
Total project outflow is 2110 cfs or less in October 50% of the time.
Total project outflow is 3360 cfs or less in October 95% of the time.

Notes: Comparison of average outlet flows of the Worst Case Hydropower Analysis to the Early Implementation Baseline in terms of flow value non-exceedance values. Note that June, July, and August turbine flow values are higher than in the baseline, coincident with the project elevations being lower (pool levels are lower because more water is let out), but that September and October values of turbine flows is lower than in the baseline (more years with not enough water to release).

Table C.1.13 Post-Processed ResSim Model Results for BiOp Minimum Flows, Worst Case Hydropower Analysis.

BiOp Flow Targets: Summary for Water Year Statistics — Simulation: Meet-M-I-Hydro-042513

Non-Exceedance Values for the Number of Days in a Water Year that Minimum Tributary Flows are Not Met	Non-Exceedance Values for 73 Water Years (Conditional formatting compares to Baseline counterpart.)						Median Non-Exceedance Values by Water Year Type							
	Early Implementation Baseline POR			Simulation POR			Early Imp. Baseline by WY Type				Simulation by WY Type			
	5%	50%	95%	5%	50%	95%	Abundant	Adequate	Insufficient	Deficit	Abundant	Adequate	Insufficient	Deficit
Cottage Grove	0	1	42	0	1	44	1	0	1	20	1	0	1	21
Dorena	0	0	22	0	0	25	0	0	1	0	0	0	1	0
Hills Creek	0	0	11	0	0	37	0	0	0	0	0	0	0	26
Fall Creek	0	0	2	0	0	2	0	0	0	0	0	0	0	0
Dexter	0	11	82	0	4	41	9	8	22	75	3	3	4	31
Blue River	0	0	10	0	0	10	0	0	0	0	0	0	0	0
Cougar	0	0	25	0	0	56	0	0	0	4	0	0	29	39
Fern Ridge	0	7	28	0	8	30	6	9	2	23	6	9	2	25
Foster	16	61	165	19	68	165	44	66	104	139	50	72	104	142
Big Cliff	0	6	62	2	20	76	2	6	3	34	16	18	18	62
Albany	0	16	55	0	13	63	17	4	1	28	14	10	0	37
Salem	1	23	83	1	28	109	9	42	44	51	9	57	58	83

Simulation value compared to Baseline:	70% and less	70% to 80%	80% to 90%	90% to 110%	110% to 120%	120% to 130%	130% and more

Non-Exceedance Value Example for Early Imp. Run, Cottage Grove Minimum Tributary Flows:
Minimum tributary flows were met all days of the year for 5% or less of the water years.
Half the time (50%) there was one day or less in a water year that minimum tributary flows were not met.
Almost always (95% of the time), 42 days or less in a water year, minimum tributary flows were not met.

Notes: Comparison of the Worst Case Hydropower Analysis run (columns with light numbers or shades of red or green instead of white fill in cells with “Simulation” in column headings) to the Early Implementation Baseline (columns with “Baseline” in heading). Values are non-exceedance for the number of days that minimum flows are NOT met, so a smaller number is better.

APPENDIX D NEPA DOCUMENTATION: CATEGORICAL EXCLUSION

CENWP-PM-E
MEMORANDUM FOR THE RECORD
SUBJECT: RECORD OF ENVIRONMENTAL EVALUATION AND COMPLIANCE FOR A SURPLUS WATER AGREEMENT IN THE COAST FORK WILLAMETTE RIVER WATERSHED

DATE PREPARED: 11 SEPTEMBER 2013

DESCRIPTION OF THE PROPOSED ACTION

The U.S. Army Corps of Engineers, Portland District (Corps) will release an additional 437 acre-feet of water from the Dorena and Cottage Grove reservoirs to support the City of Creswell's (City), Oregon increased needs. The City has requested this water to support growing municipal and industrial (M&I) needs. In response to this request, the Corps conducted a study and to determine if there are sufficient quantities of water in the Coast Fork Willamette River sub-basin to support this request (*Coast Fork Willamette River, Oregon Surplus Water Letter Report*, [Corps September 2013]). As described in the report, the Corps determined there are sufficient quantities of surplus storage, and the most efficient means to meet the City's immediate needs was using water from the Dorena and Cottage Grove conservation pool.

As described in the report letter, surplus water is classified as water stored in a Department of the Army reservoir which is not required because the authorized need never developed or the need is reduced by changes which have occurred since the reservoir was authorized and constructed. Surplus water will be released from the reservoirs between June and September to meet the City's demands during the summer conservation season when surface waters in the regions' rivers are at their lowest. Water will be withdrawn from the river downstream of the dams using the City's existing infrastructure, and no construction or ground-disturbing activities will occur.

Authority for the Corps to provide storage space in the reservoirs to M&I water supply comes from the Water Supply Act of 1958 (Title III of Public Law 85-500), as amended, 33 U.S. Code (USC) §390(b).The authority to sell surplus water for M&I purposes was granted to the U.S. Army Corps of Engineers (Corps) by Section 6 of the Flood Control Act of 1944 (Public Law 78-534), as amended. Under this authority, the Secretary of the Army is authorized to make agreements to sell surplus water to states, municipalities, private concerns, or individuals, at such prices and on such terms as deemed reasonable.

The Corps' management of the Dorena and Cottage Grove reservoirs is governed in part by the Flood Control Act of 1950, which established a basin-wide flood control and multi-purpose water development and management plan for the Columbia River Basin, encompassing the Willamette Valley Projects (which includes the Coast Fork Willamette River). As discussed in the report letter, the Flood Control Act of 1950 authorized the Willamette Valley Project for the primary purpose of flood control through House Document 531, with secondary purposes being storage of water to support the needs of navigation, hydropower generation, irrigation, water supply and fish and wildlife habitat throughout the basin. The Water Resource Development Act of 1990 added environmental protection as a primary purpose at all Corps water resource projects. The City's request for surplus water to meet M&I needs and the Corps' authority to reallocate storage space for this purpose is consistent with these acts and plans.

In 1980, the Corps prepared an Environmental Impact Statement (EIS) to examine and document the positive and negative environmental effects of the continued operation and maintenance of the Willamette Valley Project (*An Environmental Impact Statement on Operations and Maintenance of the Willamette Reservoir System, Final Edition; May 1980*). The EIS illustrated the trade-offs and specific issues associated with multiple alternatives, including discontinuance of the system as well as operational alternatives that enhanced one particular project purpose or objective. One alternative evaluated in the 1980 EIS was the partial reallocation of joint-use storage to specific authorized purposes to more accurately reflect how the reservoir system is being used between the different authorized purposes. Other alternatives evaluated maximizing the operation of the dams and reservoirs for specific project purposes, including M&I use.

When the reservoirs were authorized and constructed, it was expected that widespread irrigation would expand throughout the Willamette Valley, and the need for water to irrigate crops would necessarily increase. Water-rights certificates issued in 1954 and 1968 by the Bureau of Reclamation authorized 1.6 million acre-feet stored in the Willamette Valley Project reservoirs to be used for irrigation. However, the need for the full 1.6 million acre-feet of water to satisfy irrigation contracts never developed, and less than 5% (61,000 acre-feet) is currently used for agricultural practices. Relative to the Coast Fork Willamette River, Dorena and Cottage Grove reservoirs help supply 1,208 acre-feet of water for irrigation in the watershed and an additional 33, 081 acre-feet for irrigation along the mainstem Willamette River.

As described above, stored water that is not used because the need never developed is considered surplus water. Given the current water contracts for irrigation use, approximately 95% of the Willamette Valley Project reservoirs is considered “surplus”. For these reasons, supplying the City with up to 499 acre-feet of water for M&I use is consistent with and supported by the authorizing documents. House Document 531 authorized the use of stored water for multiple needs, and the reservoirs are currently considered “joint-use”, even though there are water rights for water released from the dams. The 1980 EIS discussed the effects associated with allocation for specific authorized purpose, including the partial reallocation of water designated for irrigation use to M&I water supply.

The project manager for the surplus water supply agreement is Eric Stricklin, 503-808-4757, or eric.t.stricklin@usace.army.mil.

LOCATION OF THE PROPOSED ACTION

For the purpose of this study, the primary areas of interest include the City of Creswell in Lane County, Oregon, and the Coast Fork Willamette River watershed in the southern-most portion of the Willamette River valley (see Figure 1). The Coast Fork watershed is 669 square miles and contains two major reservoirs: Dorena and Cottage Grove. The Row River flows out of Dorena Reservoir at river mile 7.7 to join the Coast Fork Willamette River south of the town of Cottage Grove. The Coast Fork Willamette River is dammed at river mile 29.7 to form the Cottage Grove Reservoir. The U.S. Geological Survey uses a hierarchical system of hydrologic unit codes (HUC) to categorize and delineate regions, sub-regions, basins, sub-basins, watersheds and subwatersheds, each with a unique identifier from 2-12 digits. The 4^{th} HUC (watershed) for the Coast Fork Willamette River is 17090002.

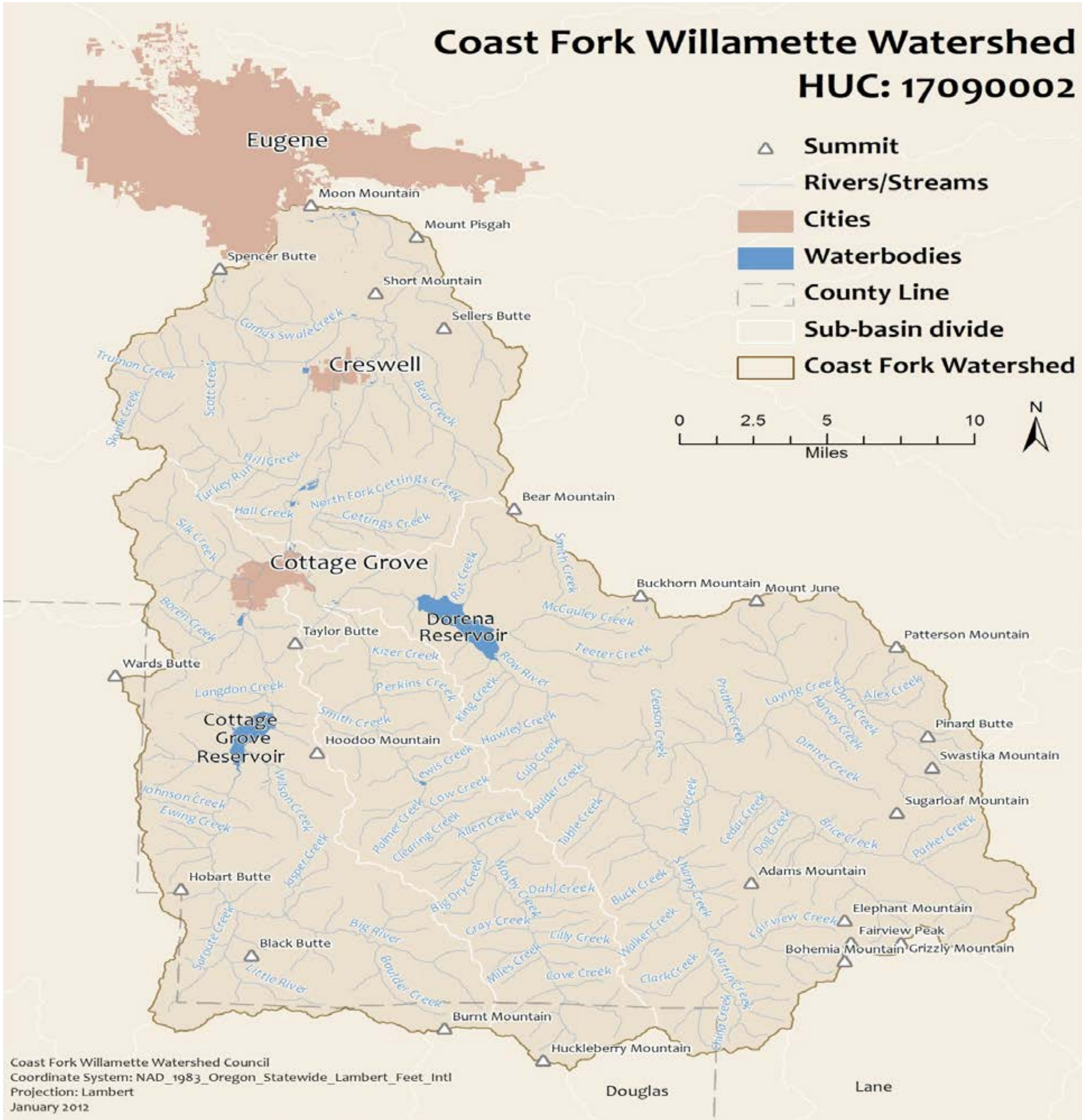

Figure 1 - Coast Fork Willamette River watershed

ENVIRONMENTAL CONSIDERATIONS:

Providing surplus water to the City will have no (measurable) effect on the existing conditions of the watershed's natural resources, including: soils; groundwater; water quality (including cold water habitat for fish); air quality; fish, wildlife and plants; cultural or historic resources.

The release of surplus water needed to satisfy 437 acre-feet of M&I water needs over the summer conservation season (a four-month period) will not adversely impact water in the reservoirs or the rivers downstream of the projects. As discussed in the letter report and the associated hydraulic analysis (Appendix C), the additional release of water from the reservoirs will result in the river experiencing an increase of up to 2 cubic feet per second (cfs) of additional flow. Typical flows in the Coast Fork

Willamette River are over 175 cfs at Goshen and 100 cfs on the Row River below Dorena. Reservoir elevations will not measurably change, and the rivers downstream of the dams will not experience a change in river stage or velocity and the additional flow (2% or less of the total flow) will not noticeably or measurably degrade water quality parameters for fish and wildlife.

The additional flow amount is so small that no measurable changes will be visible in the reservoirs throughout the Willamette Valley Project system. Recreational opportunities will not be impacted as a result of supplying the City with surplus water for M&I use during the summer season (when use of the reservoirs is highest and when M&I use is expected to be most needed). Campground and day-use areas around and downstream of the reservoirs will not be impacted and neither will recreational activities on the reservoirs (boating, fish, swimming).

In the 1980 EIS, the Corps determined that water withdrawal for M&I use has had "little effect on other project purposes or the environment, because the amount of water withdrawn is small and much of it is returned after being treated." It was assumed that most M&I use would be non-consumptive, and water would be unpolluted when it ultimately returned to the system. The Corps determined that the effects of maximizing M&I use included potential impacts to hydropower generation and recreation. However, as described in the letter report (and associated appendices), the surplus water released for M&I use will have no impact on hydropower generation or recreation of the reservoirs. Currently, there are no hydropower projects at Dorena or Cottage Grove dams and the project under construction at Dorena Dam will use discharged determined by the Corps for power generation.

ENVIRONMENTAL COMPLIANCE: The following discussions demonstrate compliance with environmental laws for operation and maintenance activities at U.S. Army Corps of Engineers (Corps) civil works, associated lands and out-grant.

National Environmental Policy Act (NEPA) of 1969: NEPA (42 U.S.C. 4321 *et seq*.) requires federal agencies to identify significant environmental resources likely to be affected by proposed activities as well as make an assessment of the impacts to those resources and consider a full range of alternative actions. Environmental considerations are fully integrated into the decision-making process.

> Finding: After review of the proposed water supply agreement, and in consideration of the laws and Executive Orders described herein, I have determined that the action qualifies as a ***categorical exclusion*** as described by NEPA and 33 Code of Federal Regulations (CFR) 230.
>
> The applicable categorical exclusion is 33 CFR 230.9 (e), *All Operations and Maintenance grants, general plans, agreements, etc., necessary to carry out land use, development and other measures proposed in project authorization documents, project design memoranda, master plans, or reflected in the project NEPA documents*. Water stored in Willamette Valley Project reservoirs is authorized for multiple purposes in the authorizing documents (per House Document 531) and reallocation of stored (surplus) water for use as M&I water supply was discussed and evaluated in previous NEPA documents (1980 EIS) which was reviewed by the public and local, state and federal government agencies. For these reasons, the water supply agreement is supported by the authorizing documents and is consistent with carrying out land use, development and other measures related to Corps projects.

Endangered Species Act (ESA) of 1973: The ESA (16 U.S.C. 1531 *et seq*.) was enacted to protect and conserve endangered and threatened species and critical habitat. Requirements established in 16 U.S.C. 1531 ensure activities authorized, funded and carried out by federal agencies are not likely to jeopardize the continued existence of any listed species or result in adverse impacts to designated critical habitat of a listed species. The U.S. Fish & Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) share responsibility for the administration of ESA listed species.

The following species and critical habitats may occur in the project area in Lane County, Oregon:

***National Marine Fisheries Service (NMFS)*:** Chinook salmon (*Oncorhynchus tshawytscha*)
http://www.nmfs.noaa.gov/gis/data/critical.htm#nw
http://www.nmfs.noaa.gov/pr/species/criticalhabitat.htm

In 1999, NMFS listed the Lower Columbia River spring Chinook (which includes Upper Willamette River populations) as *threatened* with extinction under the Endangered Species Act (ESA) of 1973, as amended (16 USC §1531 *et seq.*) (see 64 Federal Register [FR] 14308 for the final ruling). Critical habitat for Chinook was formally designated in 2005, but none was identified in the Coast Fork Willamette River watershed, including the Row River, Mosby Creek and the Upper and Lower Coast Fork Willamette Rivers (FR 2005-09-02). While these watersheds are eligible for designation based on the necessary and required habitat characteristics for spawning, migration and/or rearing, NMFS determined that the economic benefits of excluding these areas outweighed the benefits of designation.

NMFS Species Finding:
As discussed above, releasing an additional 437 acre-feet of surplus water for M&I water supply will have unmeasurable impacts on existing conditions in the watershed. The release of water will not alter or change the physical, chemical or biological conditions of the river or the watershed, resulting in no effects to fish and wildlife habitat. The release of water will result in an increase of approximately 2 cfs, which will have no measurable impacts on water quality in the reservoirs or the rivers downstream of the dams. Furthermore, the additional water will not increase velocities in the river and therefore will not influence parameters associated with water quality (temperature, pH, turbidity, etc.).

Quantities of water will be slightly increased, which will positively benefit fish during low-water years. Any water withdrawn from the rivers will be subject to minimum fish flow requirements associated with the *Endangered Species Act Section 7(a)(2) Consultation Biological Opinion and Magnuson-Stevens Fisheries Conservation and Management Act Essential Fish Habitat Consultation for the Willamette River Basin Flood Control Project, which was* issued in July 2008.

For these reasons, the minimum flow requirements for fish and wildlife will continue to be met, and the release of additional flow to support M&I needs will have "*no effect*" on ESA-listed species under NMFS' jurisdiction.

U.S. Fish and Wildlife Service (USFWS): Oregon chub (*Oregonichthys crameri*) and bull trout (*Salvelinus confluentus*)
http://www.fws.gov/oregonfwo/Species/Lists/Documents/County/LANE%20COUNTY.pdf
Oregon chub are endemic to the Willamette River, with historical populations in the Coast Fork Willamette River downstream from both Dorena and Cottage Grove dams. Oregon chub were listed as *endangered* under the ESA in 1993 and are under the jurisdiction of the USFWS. Current populations are limited to naturally occurring and reintroduced populations in the Santiam, Middle Fork, and Coast Fork Willamette Rivers. Surveys conducted in the mid-2000's found small populations (approximately 100 individuals) of chub in three locations in the Coast Fork watershed near the cities of Eugene, Creswell and Cottage Grove.

The Columbia River population of bull trout (including the Willamette River basin) was listed as *threatened* under the ESA in 1998 (63 FR 31647). The Willamette River Recovery Unit encompasses an area of approximately 19,312 miles and includes the Upper Willamette River area (including the Coast Fork watershed) and the Clackamas River. Currently, bull trout are only found in the upper portion of the Willamette basin, in the McKenzie and Middle Fork Willamette River basins and historically were found in the Santiam and Clackamas Rivers. There are no populations in the Coast Fork Willamette River watershed, and there is no critical habitat designated in the Coast Fork watershed.

USFWS Species Finding:
Similar to the reasons listed above for NMFS species, the release of an additional 437 acre-feet of surplus water for M&I water supply will have unmeasurable impacts on existing conditions in the watershed for USFWS species. Water quality and quantity will not be measurably impacted and the release will not alter the physical, chemical or biological conditions of the river or the watershed, resulting in no effects to fish and wildlife habitat.

Endangered Species Act Section 7 Consultation Biological Opinion on the Continued Operation and Maintenance of the Willamette River Basin Project and the *Effects to Oregon Chub, Bull Trout, and Bull Trout Critical Habitat Designated Under the Endangered Species Act* (BiOp) was also issued in July 2008 and contains minimum flow requirements for fish. Because the minimum flow requirements for fish and wildlife will be met, the release of additional flow to support M&I needs will have "*no effect*" on ESA-listed fish species under USFWS' jurisdiction.

> ESA-Finding: The proposed action will not disturb physical, chemical or biologic resources in the project area. Furthermore, minimum flows for ESA-listed fish are a required component of the 2008 biological opinions which further supports the continued existence and recovery of these fish. The proposed small-scale allocation will not decrease minimum flows in the Coast Fork watershed. For these reasons, the surplus water supply agreement for M&I use will have *"no effect"* on any terrestrial ESA-listed species present in the project area.

Magnuson-Stevens Fishery Conservation and Management Act (MSA) of 1976: The MSA (U.S.C. 1801 *et seq*.) is designed to actively conserve and manage fishery resources found off the coasts of the United States to support international fishery agreements for the conservation and management of highly migratory species. The MSA established procedures designed to identify, conserve and enhance Essential Fish Habitat (EFH) for fisheries regulated under a federal fisheries management plan. Essential Fish Habitat is defined as "…those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Federal agencies must consult with the NMFS on all proposed actions authorized, funded or carried out by the agency which may adversely affect EFH.

Relevant fisheries in the states of Oregon and Washington include Chinook and coho salmon, coastal pelagic species and groundfish. The following types of EFH may occur at the project site:

> Finding: As with the above determination for ESA, the effects of the proposed action will not affect ESA-listed fish or their designated critical habitat and there will be *"no adverse effect"* on EFH.

National Historic Preservation Act (Section 106) (NHPA), 1966: This Act is designed to protect and conserve cultural resources and ensure that development does not harm or degrade them. Section 106 of the NHPA requires all Federal agencies to consider the potential effects of their projects and undertakings on historic properties eligible for or currently listed on the National Register of Historic Places (National Register): http://www.cr.nps.gov/nr/. Historic properties are archaeological sites or historic structures or the remnants of sites or structures. To determine the potential effect of the project on known or unknown historic properties: the nature of the proposed activity and its effect on the landscape is evaluated; the likelihood that historic properties are present within a project area is assessed; an assessment is made as to whether the ground is disturbed by previous land use activities and the extent of the disturbance; and there is a review of listings of known archeological or historic site locations, including site data bases and areas previously surveyed or listings of sites on the National Register of Historic Places.

> Finding: On 31 July 2013, the District Archaeologist, Daniel Mulligan, determined that the proposed undertaking will result in a determination of "*no potential to affect*" and that Section 106 coordination with the Oregon State Historic Preservation Office and Native American Tribes is not required. Although Dorena Dam and Cottage Grove Dam (constructed in 1949 and 1942, respectively) are both considered historic properties, neither will be affected by the water reallocations. Furthermore, reallocation of water from the Dorena and Cottage Grove reservoirs for use in the Coast Fork sub-basin will not require additional construction, ground-disturbing activities or cause changes to the landscape; reallocation only will involve water redistribution through existing infrastructure and will not cause changes in reservoir elevations and downstream river levels. As a result, the proposed undertaking will not alter any historic properties or other significant cultural resources within the project area. No historic properties will be affected, and the proposed action complies with all applicable cultural resource laws.

Other Laws and Executive Orders

The surplus water supply agreement is confined to the Coast Fork Willamette River, including the Cottage Grove and Dorena reservoirs and areas downstream of the dam. The reallocation and release of surplus water will not involve a new water resource project, nor does it impact farmlands, cultural or natural resources (including fish and wildlife, as well as wetland and floodplain habitats). The water supply agreement will not alter or degrade the physical, chemical or biologic components in the Coast Fork watershed, including air and water quality. No birds will be negatively impacted by the release of surplus water, and no nesting habitat will be destroyed or adversely modified. The Coast Fork watershed is outside of the coastal zone and inaccessible to marine mammals. In addition, neither the Coast Fork of the Willamette River and the Row River are designated as Wild and Scenic Rivers. No communities or environmental justice populations will be impacted by the proposed small-scale reallocation.

For these reasons, the following laws do not require further review for compliance:

- Farmlands Protection Policy Act, 1994
- Clean Air Act, 1970
- Clean Water Act, 1972
- Fish and Wildlife Coordination Act, 1958
- Coastal Zone Management Act, 1972
- Marine Protection, Research and Sanctuaries Act (Section 103), 1972
- Marine Mammal Protection Act, 1972
- Bald and Golden Eagle Protection Act, 1940
- Migratory Bird Treaty Act, 1918
- Wild and Scenic Rivers Act, 1968
- Native American Graves Protection and Repatriation Act, 1990
- Executive Order 11593, Protection and Enhancement of the Cultural Environment, May 1971
- Executive Order 11988, Flood Plain Management, 24 May 1977

- Executive Order 11990, Protection of Wetlands, 24 May 1977
- Comprehensive Environmental Response, Compensation and Liability Act, 1980
- Executive Order 12898, Environmental Justice, 11 February 1994
- Executive Order 13186, Migratory Birds, 10 January 2001
- Executive Order 13514, Federal Leadership in Environmental, Energy, and Economic Performance, 5 October 2009

Prepared by: ____

Kris Lightner Date
Environmental Resource Specialist

Reviewed By: ____

Judith Marshall Date
Environmental Planning Section Chief

Authorized By: ____

Joyce Casey Date
Environmental Resources Branch Chief

APPENDIX E   PERTINENT CORRESPONDENCE

September 6, 2013

Jamon Kerit
Interim City Administrator, City of Creswell
13 S. 1st Street
P.O. Box 276
Creswell, Or. 97426

RE: Willamette Valley Project-Cottage Grove

Dear Mr. Kerit:

You have requested the use of surplus water in Cottage Grove and Dorena Reservoirs for municipal and industrial water supply purposes. Storage for such use may be available, subject to preparation and approval of a report and compliance with applicable Federal and state laws and regulations. Before proceeding, however, we must inform you of the status of the dam at Cottage Grove; along with the potential impacts on water supply storage.

While the Army Corps of Engineers recognizes the numerous public benefits of providing storage in its reservoirs for water supply purposes, the Corps also recognizes its responsibility to provide storage in a safe, secure and reliable environment. The Corps is committed to the safety of its dams.

The Corps continually evaluates its dams and determines if remediation may be necessary to meet and maintain current Corps safety standards. Corps dams are classified through a risk assessment process into five Dam Safety Actions Classes (DSAC) which represent varying levels of safety risks. In the interest of public safety, Corps water supply policy does not allow the conservation pool to be raised at projects where dams are classified DSAC I, II, III. Therefore, only storage within the existing conservation pool may be considered for water supply purposes.

The dam at Cottage Grove has been classified DSAC III-Moderate Urgency. As a result, the Corps may implement interim or long-range measures to remediate the conditions which lead to the DSAC. These measures may impact the storage in the reservoir for water supply purposes, such that the amount of storage available for water supply could be reduced. Corps water supply storage agreements require non-Federal users to share the costs of remediation in proportion to the storage space that has been provided to each user.

We will continue to work with you in your efforts to meet your present and future water needs. To this end, we continually review our projects for effectiveness, efficiency and safety. If you have questions about any matters addressed in this letter, or wish to learn more about the Corps' commitment to dam safety, please contact Mr. Matthew Craig at (503) 808-4846 or Matthew.Craig@usace.army.mil.

Sincerely,

Bruce J. Duffe
Chief, Hydrology and Hydraulics
Engineering and Construction Division
Portland District, Corps of Engineers

September 6, 2013

Jamon Kerit
Interim City Administrator, City of Creswell
13 S. 1st Street
P.O. Box 276
Creswell, Or. 97426

RE: Willamette Valley Project-Dorena Dam

Dear Mr. Kerit:

You have requested the use of surplus water in Cottage Grove and Dorena Reservoirs for municipal and industrial water supply purposes. Storage for such use may be available, subject to preparation and approval of a report and compliance with applicable Federal and state laws and regulations. Before proceeding, however, we must inform you of the status of the dam at Dorena; along with the potential impacts on water supply storage.

While the Army Corps of Engineers recognizes the numerous public benefits of providing storage in its reservoirs for water supply purposes, the Corps also recognizes its responsibility to provide storage in a safe, secure and reliable environment. The Corps is committed to the safety of its dams.

The Corps continually evaluates its dams and determines if remediation may be necessary to meet and maintain current Corps safety standards. Corps dams are classified through a risk assessment process into five Dam Safety Actions Classes (DSAC) which represent varying levels of safety risks.

The dam at Dorena has been classified DSAC IV- Low Urgency, but it does not meet all Corps safety standards. As a result, the Corps will conduct elevated monitoring and evaluation of the dam. In the event the DSAC is elevated to a higher level of risk, the Corps may implement interim or long-range measures to remediate the conditions which led to the new DSAC. These measures may impact the storage in the reservoir for water supply purposes, such that the amount of storage available for water supply could be reduced. Remediation is cost shared with water supply users in proportion to the storage space that has been provided to each user.

We will continue to work with you in your efforts to meet your present and future water needs. To this end, we continually review our projects for effectiveness, efficiency and safety. If you have questions about any matters addressed in this letter, or wish to learn more about the Corps' commitment to dam safety, please contact Mr. Matthew Craig at (503) 808-4846 or Matthew.Craig@usace.army.mil.

Sincerely,

Bruce J. Duffe
Chief, Hydrology and Hydraulics
Engineering and Construction Division
Portland District, Corps of Engineers

City of Creswell
13 S. 1st Street   PO Box 276   Creswell, Or. 97426
Ph (541) 895-2531   Fax (541) 895-3647

July 30, 2013

Colonel John W. Eisenhauer
U.S. Army Corps of Engineers, Portland District
P.O. Box 2946
Portland, OR 97208-2946

RE: Willamette Basin Project - Small Scale Reallocation Study

Dear Colonel Eisenhauer:

Since the late 1980's, the municipal water providers in the Willamette Basin have been seeking access to the water stored in the Willamette Basin projects. Today, this stored water represents a key primary and supplemental supply source for municipal water providers.

For several years, the City of Creswell has been in communication with the Oregon Water Resources Department and the Oregon Water Utilities Council regarding a potential Army Corps of Engineers-led small scale reallocation study. We understand such a study could make available up to 499 acre-feet of stored water for municipal use.

On December 13, 2010, the City of Creswell City Council voted to participate in the small scale reallocation study. Consistent with that action, the City requests that the Army Corps of Engineers initiate and complete the small scale reallocation study. It is our understanding that the City will incur no financial obligations and is not making any commitments regarding future contracts for use of the stored water.

We look forward to working with you and your staff on this important project.

Sincerely,

Jamon Kent, Interim City Administrator

APPENDIX F   DRAFT SURPLUS WATER AGREEMENT

SURPLUS WATER AGREEMENT
BETWEEN THE UNITED STATES OF AMERICA
AND
City of Creswell

FOR
SURPLUS WATER FROM
Dorena and Cottage Grove Reservoirs

THIS AGREEMENT, entered into this ____ day of _____, 2013, by and between the UNITED STATES OF AMERICA (hereinafter called the "Government") represented by the District Engineer executing this agreement, and The City of Creswell, (hereinafter called the "User");

WITNESSETH THAT:

WHEREAS, pursuant to the Flood Control Acts of 1938 (Public Law 75-761) and 1950 (Public Law 81-516) the Government constructed and operates Dorena Dam and Reservoir on Row River and Cottage Grove Dam and Reservoir on Coast Fork Willamette River, (hereinafter called the "Project"); and,

WHEREAS, Section 6 of the Flood Control Act of 1944 (Public Law 78-534), as amended, provides that the Secretary of the Army is authorized to enter into agreements with states, municipalities, private concerns, or individuals, at such prices and on such terms as he may deem reasonable, for domestic and industrial uses for surplus water that may be available at any reservoir under his control provided that no agreements for such water shall adversely affect the existing lawful uses of such water;

WHEREAS, the User desires to enter into an agreement with the Government for the privilege of withdrawing surplus water from the Project;

NOW, THEREFORE, the parties do mutually agree as follows:

ARTICLE 1 - Water Supply and Withdrawals.

a. The Government will reserve 437 acre feet of storage space in the Project in order to meet the water demands of the User. From this storage space the User shall have the privileges of withdrawing water at a rate not to exceed 1.2 MGD during the term of this contract as specified in Article 6 hereof.

b. The User shall have the right to construct, operate and maintain installations and facilities, or to enter into agreements with third parties therefore, for the purpose of withdrawing water from the Project, subject to the approval of the District Engineer as to design and location of such installation and facilities. All costs associated with such installations and facilities or any modifications thereof or any future construction in connection therewith, shall be without expense to the Government.

c. The Government reserves the right to control and use all storage in the project in accordance with authorized Project purposes. The Government further reserves the right to take such measures as may be necessary in the operation of the Project to preserve life and/or property, including the right not to make downstream releases during such periods of time as are deemed necessary, in its sole discretion, to inspect, maintain, or repair the Project.

d. The User recognizes that this agreement provides storage space for raw water only. The Government makes no representation with respect to the quality or availability of water and assumes no responsibility therefore, or for treatment of the water. The water level of the Project will be maintained at elevations which the Government deems will best serve the authorized purposes of the Project, and this agreement shall not be construed as giving the User any rights to have the water level maintained at any elevation. The User further recognizes that it is acquiring no permanent right to the use of storage in the Project.

ARTICLE 2 - Metering. For the purpose of maintaining an accurate record of the water withdrawn from the Project, the User agrees to furnish and install, or cause to be installed, meters or measuring devices satisfactory to the District Engineer, without cost to the Government. As required, the User agrees to furnish to the District Engineer advance estimates of need and records of the quantity of water actually withdrawn. Such devices shall be available for inspection by Government representatives at all reasonable times.

ARTICLE 3 - Regulation of the Use of Water. The regulation of the use of and water rights needed for the water withdrawn or released from the storage space shall be the sole responsibility of the User and under the sole authority of the User in accord with Federal, State, and local laws and shall not be considered a part of this agreement. The Government shall not be responsible for the use of water by the User, nor will it become a party to any controversies involving the water use, except as such controversies may affect the operations of the Project.

ARTICLE 4 - Consideration and Payment.

(a) In consideration of the right to withdraw 437 acre-feet between June and September for a period not to exceed five (5) years from the Project for municipal and industrial water supply purposes, the User shall pay the Government $53,131 per year for the capital costs and approximately $4,322 per year in operation and maintenance costs, the first of which shall be due and payable within thirty (30) days of the effective date of the agreement as set forth in Article 5 herein. Future payments thereafter will be due and payable on the anniversary date the first payment is due.

(b) The repayment amount shown in Article 4(a) is based upon joint use and specific water supply construction costs updated to October 2013 price levels using appropriate indices and the Fiscal Year 2013 water supply interest rate of 3.125 percent as computed by the Secretary of the Treasury in accordance with Section 932 of the Water Resources Development Act of 1986 (Public Law 99-662).

(c) If the User shall fail to make any payment under this agreement within thirty (30) days of the date due, interest thereon shall accrue at the rate as determined by the Department of Treasury's Treasury Fiscal Requirements Manual (1 TFRM 6-8000, "Cash Management") and shall compound annually from the date due until paid. This provision shall not be construed as waiving any other rights the Government may have in the event of default by the User, including but not limited to the right to terminate this agreement for default.

ARTICLE 5 - Duration of Agreement. This agreement shall become effective as of the date of the approval by the Secretary of the Army or his duly authorized representative, and shall continue in full force and effect under the conditions set forth herein, for a period of not to exceed five (5) years from the said date of approval. Upon expiration, this agreement may be extended by mutual agreement for additional periods of not to exceed five (5) years each. All such agreement extensions shall be subject to recalculation of reimbursement. Nothing in this agreement, nor in any extension thereto, shall imply a permanent right to utilize the storage space.

ARTICLE 6 - Termination of Agreement.

a. Either party may terminate this agreement and the privilege of withdrawing water upon 30 days written notice. In the event of termination under this paragraph, the Government will make pro rata refund for any balance of the agreement term for which payment has been made and the User will pay all charges which have accrued through the date of the termination.

b. The Government may terminate this agreement and the privilege of withdrawing water upon ninety (90) days written notice, if the User shall default in performance of any obligation of this agreement. Upon such a termination, User shall continue to be liable to the Government for any monies owned and for any costs incurred by the Government as a result of the default.

c. In the event of any termination pursuant to this Article or Article 5, User shall, upon request of the District Engineer, promptly remove, at User's own expense, any facilities constructed on Project land for water withdrawal and restore premises around the removed facilities to a condition satisfactory to the District Engineer.

ARTICLE 7 - Rights-of-Way. Occupancy and use of Project lands shall be in accordance with any permits, rights-of-way, or easements granted to the User by the Government.

ARTICLE 8 - Release of Claims. The User shall hold and save the Government, including its officers, agents, and employees, harmless from liability of any nature or kind for or on account of any claim for damages which may be filed or asserted as a result of the withdrawal or release of water from the Project made or ordered by the User, or as a result of the construction, operation or maintenance of any facilities or appurtenances owned and operated by the User except for damages due to the fault or negligence of the Government or its contractors.

ARTICLE 9 - Transfer or Assignment. The User shall not transfer or assign this agreement nor any rights acquired thereunder, nor suballot said water or storage space or any part thereof, nor grant any interest, privilege or license whatsoever in connection with this agreement, without the approval of the Secretary of the Army or his duly authorized representative provided that, unless contrary to public interest this restriction shall not be construed to apply to any water which may be withdrawn or obtained from the water supply storage space by the User and furnished to any third party or parties or to the rates charged therefor.

ARTICLE 10 - Officials Not to Benefit. No member of or delegate to Congress, or Resident Commissioner, shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.

ARTICLE 11 - Covenant Against Contingent Fees. The User warrants that no person or selling agency has been employed or retained to solicit or secure this agreement upon an agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by the User for the purpose of securing business. For breach or violation of this warranty, the Government shall have the right to annul this agreement without liability, or in its discretion, to add to the agreement price or consideration the full amount of such commission, percentage, brokerage, or contingent fee.

ARTICLE 12 - Environmental Quality. During any construction, operation, and maintenance by the User of any facilities, specific actions will be taken to control environmental pollution which could result from such activity and to comply with applicable Federal, State and local laws and regulations concerning environmental pollution. Particular attention should be given to (1) reduction of air pollution by control of burning, minimization of dust, containment of chemical vapors, and control of engine exhaust gases, and of smoke from temporary heaters; (2) reduction of water pollution by control of sanitary facilities, storage of fuels and other contaminants, and control of turbidity and siltation from erosion; (3) minimization of noise levels; (4) onsite and offsite disposal of water and spoil; and (5) prevention of landscape defacement and damage.

ARTICLE 13 - Federal and State Laws.

a. The User shall utilize the water withdrawn from the Project in a manner consistent with Federal, State, and local laws.

b. The User furnishes, as part of the agreement, an Assurance of Compliance with Title VI of the Civil Rights Act of l964 (78 Stat. 252; 42 U.S.C. 2000d, et seq) and Department of Defense Directive 5500.11 issued pursuant thereto and published in Part 300 of Title 32, Code of Federal Regulations.

c. Any discharges of water or pollutants into a navigable stream or tributary thereof resulting from the User's facilities and operations undertaken under this agreement shall be performed only in accordance with applicable Federal, State and local laws and regulations.

ARTICLE 14 - Approval of Agreement. This agreement shall be subject to the written approval of the Secretary of the Army or his duly authorized representative and shall not be binding until so approved.

IN WITNESS WHEREOF, the parties have executed this agreement as of the day and year first above written.

APPROVED: THE UNITED STATES OF AMERICA

________________ By___________________________

John W. Eisenhauer, P.E. (District Engineer)

Colonel, U.S. Army

District Commander

DATE:_______ By City of Creswell ___________________________

[Title]

EXHIBIT A
CERTIFICATION

I ____________, Attorney for the the City of Creswell, have reviewed the foregoing agreement executed by ____________, and as principal legal officer for the City of Creswell certify that I have considered the legal effect of Section 221 of the 1970 Flood Control Act (Public Law 9l-6ll) and find that the City of Creswell is legally and financially capable of entering into the contractual obligations contained in the foregoing agreement and that, upon acceptance, it will be legally enforceable.

Given under my hand, this _______ day of ________ 2013.

____

Attorney for the City of Creswell

EXHIBIT B

The total cost charged to the user for 437 acre-feet of storage for five years is $265,655. For a surplus water supply agreement, the user will pay the annual fees as listed in the table below.

TOTAL ANNUAL COST TO USER
FOR SURPLUS WATER SUPPLY STORAGE

Item	Type of Use	Computation	Cost
Interest and amortization	Annual cost of storage space	$2345 x 437 factor based on 30 payments at interest rate of 3.125%.	$53,131
Operation and maintenance [1]	Joint-use actual for FY 12*	0.027% [2] x $16,005,378	$4,322
Repair, rehabilitation and replacement [3]	Joint-use actual for FY 12*	0.027% [2] x $0	$0

*FY13 dollar figures not available at time of report. These figures will be updated before the agreement is sent to the ASA(CW) for approval.

Notes:

1 Payment due and payable on the date specified in Article 4(a).

2 Percent of Users share of the Usable storage space in the project (column (4) of exhibit B-I).

3 Repair, rehabilitation and replacement costs are payable only when incurred as specified in Article 5(b).

EXHIBIT C

Coast Fork Willamette River, Oregon
Surplus Water
Letter Report