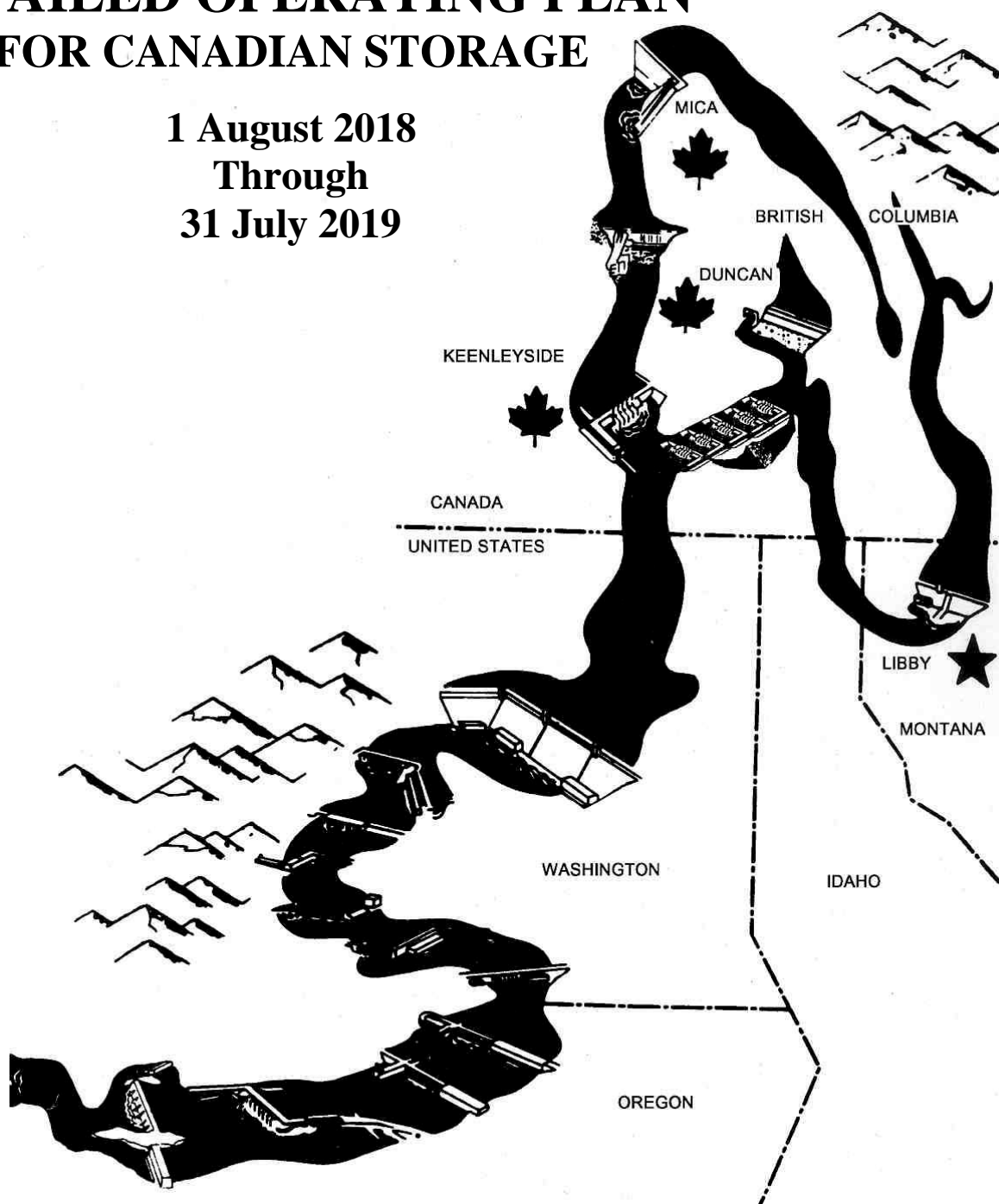


# COLUMBIA RIVER TREATY DETAILED OPERATING PLAN FOR CANADIAN STORAGE

1 August 2018  
Through  
31 July 2019



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**COLUMBIA RIVER TREATY ENTITY AGREEMENT ON THE  
DETAILED OPERATING PLAN  
FOR CANADIAN STORAGE**

**1 AUGUST 2018 THROUGH 31 JULY 2019**

Article XIV 2.(k) of the Columbia River Treaty between Canada and the United States of America (Treaty) provides that the power and duties of the Entities include "*preparation and implementation of detailed operating plans that may produce results more advantageous to both countries than those that would arise from operation under the plans [Assured Operating Plans (AOP)] referred to in Annexes A and B.*"


The Entities agree that Canadian storage shall be operated and electric power delivered in accordance with the attached "Detailed Operating Plan for Canadian Storage – 1 August 2018 through 31 July 2019" (the 2018-19 Detailed Operating Plan), dated June 2018.

The Entities agree that the "Columbia River Treaty Principles and Procedures for Preparation and Use of Hydroelectric Operating Plans for Canadian Treaty Storage," dated November 2003, or any future document the Entities agree supersedes the 2003 document, and any Appendices approved by the Operating Committee, will guide the Entities in implementing the 2018-19 Detailed Operating Plan.

In witness thereof, the Entities have caused this Agreement to be executed.

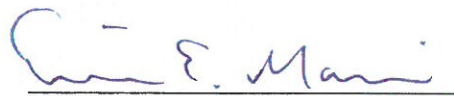
Executed for the Canadian Entity this 12<sup>th</sup> day of July, 2018.

By

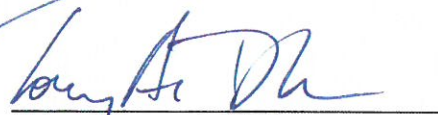
  
Chris O'Riley  
Chair

Executed for the United States Entity this 11<sup>th</sup> day of July, 2018.

By

  
Elliot E. Mainzer  
Chairman

By

  
Colonel Torrey A. DiCiro  
Acting Member

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## TABLE OF CONTENTS

<b>I.</b>	<b>REFERENCES AND INTERPRETATION.....</b>	<b>1</b>
<b>II.</b>	<b>PREPARATION AND SCOPE .....</b>	<b>2</b>
	A. GENERAL.....	2
	B. STORAGE AMOUNTS .....	3
	C. FLOOD RISK MANAGEMENT .....	3
	D. PREPARATION OF THE TREATY STORAGE REGULATION (TSR) STUDY .....	4
	E. AUTHORIZATION FOR CHANGES TO THE TSR .....	6
	F. LIBBY .....	6
<b>III.</b>	<b>POWER DELIVERIES.....</b>	<b>6</b>
	A. DELIVERY OF THE CANADIAN ENTITLEMENT .....	6
	B. LIBBY COORDINATION AGREEMENT (LCA) POWER .....	6
	C. SHORT-TERM LIBBY AGREEMENT (STLA) .....	7
	D. OPERATIONAL AGREEMENT POWER .....	7
<b>IV.</b>	<b>STORAGE OPERATION.....</b>	<b>7</b>
	A. OPERATION AUTHORITY .....	7
	B. CANADIAN STORAGE OPERATION .....	7
	C. OBJECTIVES FOR SUPPLEMENTAL OPERATING AGREEMENTS (SOAs).....	8
	D. PROVISIONAL OPERATION AT ARROW .....	8
<b>V.</b>	<b>SCHEDULING STORAGE REGULATION .....</b>	<b>8</b>
	A. OPERATING DATA .....	8
	B. VOLUME RUNOFF FORECASTS .....	8
	C. TREATY STORAGE REGULATION STUDY.....	9
	D. IN-SEASON FRM DEVIATIONS IN THE TREATY STORAGE REGULATION STUDY .....	9
	E. SCHEDULING AGREEMENTS.....	9
<b>VI.</b>	<b>OPERATING GUIDES .....</b>	<b>12</b>
	A. OPERATING RULE CURVE (ORC) .....	12
	B. RULE CURVES AND OPERATING DATA .....	12
	C. RESERVOIR STORAGE/ELEVATION TABLES .....	13
<b>VII.</b>	<b>OPERATING LIMITS.....</b>	<b>13</b>
	A. DUNCAN PROJECT .....	13
	B. ARROW PROJECT .....	13
	TABLE 1 – ARROW PROJECT OPERATING CRITERIA (APOC).....	15
	C. MICA PROJECT.....	16
	TABLE 2 – MICA PROJECT OPERATING CRITERIA (MPOC) .....	17
	<b>EXHIBITS.....</b>	<b>18</b>
	EXHIBIT 1 - ASSURED REFILL CURVES (ARC).....	18
	EXHIBIT 2 - CRITICAL RULE CURVES (CRC) .....	19
	EXHIBIT 3 - OPERATING RULE CURVE LOWER LIMITS (ORCLL) .....	19
	EXHIBIT 4 - VARIABLE REFILL CURVE (VRC) PROCEDURES .....	20
	EXHIBIT 5 - COORDINATED SYSTEM LOADS AND RESOURCES USED IN AOP19.....	21
	EXHIBIT 6 – U.S. TSR CRITICAL RULE CURVES AND ARCS .....	22
	EXHIBIT 7 – U.S. POWER DISCHARGE REQUIREMENTS (PDRs) AND VRC LOWER LIMITS (VRCLLs).....	24
	EXHIBIT 8 – U.S. OPERATING RULE CURVE LOWER LIMITS .....	24
	EXHIBIT 9 - COMPOSITE CANADIAN STORAGE CONTENTS .....	25
	EXHIBIT 10 – DUNCAN RESERVOIR STORAGE/ELEVATION TABLE.....	27
	EXHIBIT 11 – ARROW RESERVOIR STORAGE/ELEVATION TABLE .....	30
	EXHIBIT 12 – MICA RESERVOIR STORAGE/ELEVATION TABLE.....	32

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**COLUMBIA RIVER TREATY  
DETAILED OPERATING PLAN  
FOR CANADIAN STORAGE  
1 AUGUST 2018 THROUGH 31 JULY 2019**

**I. REFERENCES AND INTERPRETATION**

In this document:

- A. “Aspects Agreement” means the Entity Agreement on Aspects of the Delivery of the Canadian Entitlement for 1 April 1998 through 15 September 2024 between the Canadian Entity and the United States Entity, dated 29 March, 1999, together with its Attachment A – Points of Delivery and Attachment B - Scheduling Guidelines, as those Guidelines may be subsequently modified or amended by the Operating Committee.
- B. “Assured Operating Plan” (AOP) means the hydroelectric operating plan developed in accordance with the Columbia River Treaty (Treaty) for the Operating Year as further described in the document “Columbia River Treaty Hydroelectric Operating Plan - Assured Operating Plan for Operating Year 2018-19 (AOP19) executed December 2013.”
- C. “Canadian storage” means the storage provided by Canada under Article II of the Treaty, which is a total of 15.5 million acre feet (Maf) at the Mica, Duncan, and Arrow reservoirs.
- D. “Detailed Operating Plan” (DOP) means a detailed operating plan prepared for the Operating Year by the Operating Committee pursuant to the guidelines provided in the Principles and Procedures and consisting of the contents of this document.
- E. “Flood Control Operating Plan” (FCOP) means the document “Columbia River Treaty Flood Control Operating Plan, dated May 2003,” including any published updates.
- F. “Libby Coordination Agreement” (LCA) means the “Columbia River Treaty Entity Agreement Coordinating the Operation of the Libby Project With the Operation Of Hydroelectric Plants on the Kootenay River and Elsewhere in Canada,” dated 16 February 2000.
- G. “Libby Operating Plan” (LOP) means the operating plan prepared by the U.S. Army Corps of Engineers (Corps of Engineers) on behalf of the U.S. Entity for the Libby project in accordance with Section 9 of the LCA, and incorporated as Attachment B to the LCA.
- H. “Operating Committee” means the Columbia River Treaty Operating Committee (CRTOC).
- I. “Operating Year” means the period from 1 August 2018 through 31 July 2019.
- J. “Principles and Procedures” (POP) means the document “Columbia River Treaty Principles and Procedures for Preparation and Use of Hydroelectric Operating Plans for Canadian Treaty Storage,” dated October 2003, or any future document the Entities agree supersedes the 2003 document, and any updated Appendices approved by the Operating Committee.
- K. “Short Term Libby Agreement” (“STLA”) means the “Columbia River Treaty Short-Term Entity

Agreement on Coordination of Libby Project Operations,” dated 27 September 2013, which supplements the Libby Coordination Agreement and establishes an Arrow Provisional Account of 50 ksf storage and 550 ksf draft available for use by the Canadian Entity under terms of the STLA. The STLA has been extended to be in effect for the duration of this DOP19.

- L. “Supplemental Operating Agreement” (SOA) means any operating agreement(s) (signed either by the Entities or the Operating Committee) that authorize Canadian storage operations above or draft below the Treaty Storage Regulation levels as described in Section IV(A) of this DOP and Section 11 of the LCA, but not including Section 10 of the LCA.
- M. “Treaty Storage Regulation” (TSR) means the Coordinated System hydro regulation study performed for the Operating Committee by Bonneville Power Administration (BPA) staff using actual and forecasted streamflow conditions and implementing operating criteria contained in this DOP, including any changes agreed to under subsection II(E), but excluding subsection IV(D) and SOA operations authorized under subsection IV(A). The TSR is used in accordance with POP and this DOP to determine operational Treaty rights to monthly regulation of Treaty storage.
- N. “Weekly Treaty Storage Operation Agreement” means the note electronically transferred (e-mail or Fax) the last working day of each week from the U.S. Section to the Canadian Section of the Operating Committee to confirm the verbal agreement by the Operating Committee for the weekly Treaty storage changes and outflows that implement this DOP, including any changes agreed to under subsection II(E) and Section IV.

Other capitalized terms used in this document, not defined above, should be interpreted to have the meaning ascribed to them in POP (either in the definitions or the text), the FCOP or the generally accepted meaning within the industry in the Columbia River Basin.

## **II. PREPARATION AND SCOPE**

### **A. General**

This DOP for Canadian storage is based on the operating criteria contained in the AOP19 and its supporting hydro regulation studies with agreed revisions noted in subsection II (D) below, together with scheduling procedures and mutually beneficial changes from the AOP19 data agreed to by the Canadian Entity and the U.S. Entity (Entities).

This DOP was developed in accordance with the procedures outlined in the POP. This DOP document includes storage/elevation tables for the Canadian storage projects that have been extended to include potential surcharge elevations. These are provided in Exhibits 10, 11, and 12. The project data contained in these exhibits were not used in either the AOP19 or the DOP19 studies, but are provided for information purposes for actual project operations, which can, at times, exceed normal Treaty limits.



**B. Storage Amounts**

The 15.5 Maf of usable Canadian storage space available for improving the flow of the Columbia River during the Operating Year is distributed as follows:

Duncan Reservoir

1.4 Maf (705.8 thousand second-foot-days (ksfd)) between elevations 1,892.0 feet and 1,794.2 feet as measured at Duncan forebay, and based on British Columbia Hydro and Power Authority (B.C. Hydro) table dated 21 February 1973 and updated 1 February 2013.

Arrow Reservoir

7.1 Maf (3,579.6 ksfd) between elevations 1,444.0 feet and 1,377.9 feet as measured at Fauquier, B.C., and based on B.C. Hydro table dated 28 February 1974 and updated 1 February 2013. It is recognized that, for dam safety purposes, a reservoir level gauge at the Keenleyside Dam may be used to limit the maximum Arrow Reservoir actual elevation.

Mica Reservoir

7 Maf (3,529.2 ksfd) between elevations 2,475.0 feet and 2,320.9 feet as measured at the Mica Dam forebay, and based on B.C. Hydro table dated 25 March 1974 and updated 1 February 2013. The total available storage between these elevations is 12 Maf (6,050.0 ksfd), but Canadian storage is only 7 Maf (3,529.2 ksfd), except as described in paragraph VII(C)6.

**C. Flood Risk Management**

The requirements for flood risk management (FRM) operations are defined in the Treaty and are further described in the FCOP. In accordance with Sections 3-1 and 6-6 of the FCOP, the Canadian Entity selected for the AOP19 a maximum exchange of FRM space from Arrow to Mica. The exchange results in a Mica/Arrow system FRM storage allocation of 4.08 Maf at Mica and 3.6 Maf at Arrow for the Operating Year. The Canadian storage dedicated to FRM purposes during the Operating Year will be 1.27 Maf in Duncan Reservoir below elevation 1,892.0 feet, 3.6 Maf in Arrow Reservoir below elevation 1,444.0 feet, and 4.08 Maf in Mica Reservoir below elevation 2,475.0 feet. Additional storage in the Columbia River Basin in Canada may also be operated for FRM purposes in accordance with provisions in the Treaty and Section 3-2 of the FCOP.

During the 2018-19 Operating Year, the Canadian Entity may request a different allocation of Mica/Arrow system flood space. To the extent that the requested allocation differs from that included in the AOP19, the Operating Committee will develop and execute an agreement that will result in the same Treaty flows at the U.S.-Canadian border as that provided in the AOP19 as modified in subsection II(D), unless otherwise agreed by the Operating Committee.

During the refill period, the Canadian Section of the Operating Committee may request local FRM elevations for Arrow with the intent to minimize the occurrence of flows above 180 kcfs at Trail (as measured at Birchbank) or as updated with best available information based on B.C. Hydro operating policies for flood impacts. This local FRM objective in Canada, which is below 225 kcfs as documented in Section 4.3 of the FCOP, will be included in the FRM rule curve and input as the Upper Rule Curve in the TSR studies only to the extent that it does not jeopardize system FRM needs.

In order to accommodate local minimum flow requirements downstream of Duncan Dam beginning with the 2009-10 Operating Year, the Canadian Entity has requested a permanent variance to the February Duncan FRM draft requirements in the May 2003 FCOP. The Corps of

Engineers has agreed to the permanent variance.

**D. Preparation of the Treaty Storage Regulation (TSR) Study**

The TSR study uses DOP operating criteria for both Canadian and U.S. projects to define a Canadian storage operation. Operating criteria for major U.S. projects are detailed in Exhibits 6, 7 and 8. The TSR19 study shall be based on the loads, thermal and other resources, rule curves, non-power constraints, and other plant and operating data contained in the AOP19 Step I hydro regulation study, except for the following changes agreed to by the Entities:

1. FRM rule curves for Canadian projects defined as noted in subsection II(C) above unless otherwise agreed by the Operating Committee.
2. The hydro-independent (HI) generation included in the Actual Energy Regulation (AER) under the Pacific Northwest Coordination Agreement (PNCA), plus other HI generation based upon the 80-year median values for all other HI projects not updated in the AER and for which updates are not available from the project owner will be used. The eight Federal Willamette projects (Big Cliff, Detroit, Foster, Green Peter, Cougar, Dexter, Lookout Point, and Hills Creek) will be added to the TSR hydro-regulation model and will be operated with the inflow and elevation data submitted by the Corps of Engineers for the AER.
3. The eight Federal Willamette projects are regulated in the TSR, using operational constraints from the Corps of Engineers' February 2017 PNCA data submittal or as updated in-season and agreed to by the Operating Committee.
4. Forecast errors and distribution factors are based on the historic 80-year 2010 Modified Streamflow record, and as updated in Appendix 8 of the 2003 POP. Forecast errors were most recently updated and approved by the CRTOC in January 2018. The Operating Committee may revise forecast errors and distribution factors in accordance with subsection II(E).
5. The 1 February 2018 PNCA data submittal for Grand Coulee pumping flows (based on net flow from pumping and generation at the pumps/generators) or current forecast values if available will be used for current and future periods. Actual values for after-the-fact periods will be used. Adjustments to return flows are not needed because the observed streamflows and streamflow forecasts include return flows.
6. Operation of Canadian Projects was based upon the most-recently updated plant data submitted under the PNCA in February each year. Plant data updates that occurred after AOP19 include Mica (2015) and Waneta (2015).
7. Operation of Arrow project is based upon plant data included in PNCA planning with the February 2016 PNCA data submittal. Use of updated Arrow (HLK) nonpower discharge data to reflect limited use of Low Level Operating Gate 1 (LLOG1) for flood routing purposes and other emergencies only as per Dam Safety request.
8. Use of forecasted streamflows as a percentage of 80-year medians from the 2010 Modified Flows without Grand Coulee pumping.
9. Use of the hydro-regulation model PCHYDSIM version 29, or a later version if agreed upon by the Operating Committee.

10. During the FRM evacuation period, the FRM curves at Grand Coulee may be adjusted to recognize drafts below the FRM levels at upstream storage reservoirs (including Canadian Treaty projects) in accordance with the latest update to the “Standard Operating Procedure for Computation of Flood Control Criteria for Treaty Storage Regulation and Actual Energy Regulation Models” agreed to by the Operating Committee.
11. Dworshak target contents used for July and mid-August correspond to the median elevations developed by the Corps of Engineers in their HYSSR 80 year study to achieve smooth outflows during this time.
12. The operation of Alder, Mayfield, Merwin, Mossyrock, Swift #1, Swift #2, and Yale will be based on past actual inflows and elevations, and the 80-year median inflows and the median Variable Energy Content Curves for future periods.
13. Plant data used in modeling of project operations were updated from the data used in AOP19 based on the data most recently submitted for PNCA planning. A partial list of U.S. Projects with updated data includes: Box Canyon (2016), Cabinet Gorge (2016), Chelan Lake (2014 & 2016), Chief Joseph (2016), Dworshak (2016), Faraday (2011; not modeled until 2013), Hungry Horse (2016), Ice Harbor (2016), Kerr (2015), Libby (2016), Little Falls (2016), Little Goose (2016), Long Lake (2016), Lower Granite (2016), Monroe Street (2016), Nine Mile (2016), North Fork (2011; not modeled until 2013), Noxon (2016), Pelton (2011; not modeled until 2013), Post Falls (2016), Priest Rapids (2006 Adjustment), River Mill (2011; not modeled until 2013), Round Butte (2011; not modeled until 2013), Upper Falls (2016), and Wanapum (2016).
14. Project operating constraints used in modeling of project operations were updated based on PNCA data submittals. A partial list of U.S. Project with changing operating constraints includes: Gorge (2013), Hungry Horse (2016), Little Goose (2014), Lower Baker (2013 & 2014), Lower Granite (2014), Lower Monumental (2014 & 2016), Ross (2013), and Upper Baker (2013 & 2016).
15. An updated storage vs elevation table for Grand Coulee was originally provided by the BoR in their February 2015 PNCA data submittal. This new storage vs elevation table for Grand Coulee, along with its associated plant data tables and constraint files, continues to provide guidance in modeling project operations. To model this new storage vs elevation data, new tables and constraint files were developed, including the limits and the maximum discharge tables, the FRM rule curves, Critical Rule Curves (CRC), Energy Content Curve Lower Limits (ECCLL) and Variable Refill Curve Lower Limits (VRCLL) values, and the minimum and maximum storage values.
16. Adjusted HYDDEF Switch A42.8A to FALSE, to read the Merwin minimum flows from the correct source (HYDSIM QLIM file);
17. Adjusted HYDDEF Switch A60.3 to FALSE, to turn off Lower Granite’s Sliding Scale Water Budget logic;
18. Used the Mica Project Operating Criteria (MPOC) and Arrow Project Operating Criteria (APOC) from the AOP 2241 Study, as agreed by the Entities. Arrow Project Operating Criteria (APOC) will be updated based on the procedures defined in subsection VII(B)7 of this DOP. This includes minimum flow limits which may be reduced as needed to as low as 5,000 cfs to avoid drafting the combined Mica and Arrow storage below 14.1 Maf.

Although not changed from the AOP19, some notable assumptions for this TSR include:

19. U.S. FRM curves will include VarQ at Hungry Horse but not at Libby, and will not include Variable End-of-December FRM rule curves at Libby or shifted FRM spaces from Brownlee and/or Dworshak to Grand Coulee.

The Canadian FRM curves will not include impacts due to VarQ and Variable End-of-December FRM rule curves at Libby or any impacts related to shifting of FRM spaces from Brownlee and/or Dworshak to Grand Coulee unless otherwise agreed by the Operating Committee.

20. The Variable Refill Curve Lower Limits (VRCLLs) are used at Grand Coulee only and are fixed for all three forecast levels, 80, 95, and 110 Maf, respectively, using the January through July runoff forecast at The Dalles (TDA). The January and February Grand Coulee VRCLL values are the same as its ORCLL, while the March to June VRCLL are based on historic minimum elevations for firm power operation of 1,225 feet in March-April, 1,240 feet in May, and 1,285 feet in June.

The TSR includes the operating guides and limits discussed in Sections VI and VII of this DOP.

**E. Authorization for Changes to the TSR**

The Operating Committee is authorized to modify the TSR only as needed to correct errors or omissions, update forecast data and procedures, and update the hydroregulation model.

**F. Libby**

Libby operating limits and the expected operation of the Libby project are not included in the DOP. That information is available in the Libby Operating Plan that will be updated by the U.S. Entity when planned operations change. The operation of Libby in the TSR19 will be based on criteria used in the AOP19 Step 1 study. Libby operating criteria for use in the TSR are shown in Exhibits 6, 7 and 8.

**III. POWER DELIVERIES**

**A. Delivery of the Canadian Entitlement**

The obligation of the United States to return the Canadian Entitlement to Canada for the Operating Year based on the AOP19 is:

Capacity Entitlement = 1284.0 MW  
Energy Entitlement = 472.5 annual aMW

Arrangement for the delivery of this Canadian Entitlement power, including the point of delivery, transmission losses, and scheduling guidelines, are defined by the Aspects Agreement, and Articles V and VIII of the Columbia River Treaty. Section 11 of Attachment B to the Aspects Agreement delegates to the Operating Committee the responsibility for modifying or amending Attachment B - Scheduling Guidelines, as needed from time to time.

**B. Libby Coordination Agreement (LCA) Power**

In accordance with Section 7(b) of the LCA, the Canadian Entity shall deliver to the U.S. Entity one (1) aMW, shaped flat, during the Operating Year.

Section 10 and Attachment C of the LCA relating to the provisional draft of Arrow reservoir are suspended during the period the STLA is in effect.

**C. Short-term Libby Agreement (STLA)**

The Entities signed the STLA on 27 September 2013 to address issues raised by the Canadian Entity concerning adoption by the U.S. of the VarQ flood control regime for Libby Dam operations. The STLA has been extended to be in effect for the duration of this DOP19.

The STLA provides the Canadian Entity with additional flexibility to draft from, and to store into, Arrow Reservoir. Energy values associated with Arrow provisional transactions are to be settled in financial payments.

During the term that the STLA is in effect, the LCA shall also remain in effect except that the portions related to Arrow Provisional draft, Section 10 and Attachment C, are suspended during this same effective time period.

**D. Operational Agreement Power**

In accordance with Section IV of this DOP, the Entities shall make arrangements to deliver and/or receive power required by any SOA. The Entities hereby authorize and direct B.C. Hydro and BPA to make suitable arrangements for delivery of Operational Agreement Power at the points of interconnection between B.C. Hydro and the Federal Columbia River Transmission System.

**IV. STORAGE OPERATION**

**A. Operation Authority**

The operation of Canadian storage by the Operating Committee during the period 1 August 2018 through 31 July 2019 shall be in accordance with this DOP, the FCOP, the LCA, STLA, and any SOA applicable to this Operating Year. Consistent with the operating objectives in this section, the Operating Committee is authorized to enter into SOAs consistent with the objectives defined in subsection IV(C) that adjust flow requirements to store above or draft below end-of-period TSR levels, and may include the delivery of power, for mutual benefits that occur during the span of this DOP.

**B. Canadian Storage Operation**

The Weekly Treaty Storage Operation Agreements shall be based on operating Canadian storage to the end-of-period contents contained in the current TSR study, and any operations under SOAs and the LCA/STLA (as described in subsections C and D below), or as required by the FCOP. Due to the normal variation of power load and streamflow during any period, straight-line interpolation between the period-end points should not be assumed.

From time to time, due to updated forecasts or differences between forecast and actual inflows, the actual operation of Treaty composite storage will differ from the end-of-period storage prescribed by the TSR as modified by SOA, LCA/STLA, or FRM operations. The Operating Committee will make reasonable efforts to correct these inadvertent differences via the regular Weekly Treaty Storage Operation Agreements in a timely manner without exceeding the specified project limits for discharges and ramp-rates.

**C. Objectives for Supplemental Operating Agreements (SOAs)**

Consistent with the FCOP and operating limits defined in Section VII (excluding subsection VII(B)7) of this DOP, the objectives for SOAs may include the following:

1. Power Objectives:

Power objectives include minimizing spill and optimizing energy production and power value. Operations for power objectives may be combined with non-power objectives. When appropriate, the Operating Committee will make suitable arrangements for delivery of power relating to sharing of benefits from operational agreements.

2. Non-power Objectives:

Potential Canadian non-power objectives may include, but are not limited to, whitefish and trout spawning downstream of Arrow, dust storm avoidance upstream of Arrow, and recreation objectives. Potential U.S. non-power objectives may include, but are not limited to, storage of water up to 1 Maf for anadromous fish flow augmentation, minimum flows at Bonneville Dam and at Vernita Bar for fish spawning, and recreation needs. Non-power objectives considered in this section do not include FRM and operating limits in Section VII.

Recognizing that it may not be possible to meet all non-power objectives, the Operating Committee shall in general attempt to share equally the risk and amount of failure. The parties shall make reasonable efforts to use available flexibility at their projects prior to requesting changes to the Treaty storage operation.

Operations designed to meet non-power objectives should not be construed or interpreted as imposing any obligation, domestic or international, to meet these non-power objectives. Any non-power operations undertaken by the Entities under this agreement should not be construed or interpreted as establishing or setting an Entity final decision or position concerning current or future disputes over Treaty rights and obligations. Nor do the discretionary non-power operations create or establish any binding non-power objectives, including any non-power flow objectives and contents. Nothing in the discretionary non-power operations under this agreement is intended to create any third party beneficiaries.

**D. Provisional Operation at Arrow**

The Canadian Section of the Operating Committee may utilize flexibility to alter flows out of Arrow reservoir which would result in composite Treaty storage below or above TSR levels in accordance with Section 6 of the STLA.

**V. SCHEDULING STORAGE REGULATION**

**A. Operating Data**

The Operating Committee will exchange all current operating data necessary for the regulation of Canadian storage projects as soon as available, including the beginning and end of the FRM season.

**B. Volume Runoff Forecasts**

Seasonal runoff volume forecasts for Canadian Treaty Projects shall be made available by the Canadian Section no later than the fourth working day of each month, as required, unless otherwise agreed by the Operating Committee. The Operating Committee may request forecasts of seasonal runoff volume at periods other than those representing month-end conditions if hydrologic conditions warrant. Seasonal runoff volume forecasts for the Columbia River at The Dalles, Oregon, shall be made available by the U.S. Section no later than the third working day of each month, as required.

**C. Treaty Storage Regulation Study**

The TSR study is performed at least twice each month (within the first nine working days and the last eight working days of each month, unless otherwise agreed on by the Operating Committee). Actual and forecasted unregulated streamflows will be updated for each TSR study. Variable refill curves, FRM storage evacuation requirements, and variable FRM refill curves will be updated for the first TSR of the month. At the request of either section of the Operating Committee, additional TSR studies shall be performed to reflect the most current unregulated streamflow forecasts and rule curves. The Operating Committee shall agree on procedures for developing streamflow forecasts and rule curves at that time. Additional information regarding TSR study input may be found in POP Section 4.4A and POP Section 4.4B.

Errors and omissions in the TSR will be handled as follows, unless otherwise agreed:

1. All identified errors, omissions, or revisions in the TSR issued during the current Operating Year will be documented and reported to the Operating Committee.
2. Errors/omissions identified within two working days of the initial TSR distribution which, in the view of either Section, may affect the final TSR for the previous operation period or which may impact operations prior to issuance of the next TSR, will be corrected immediately and the TSR re-run. If such errors/omissions are identified after the two-day review period, the TSR will be corrected only if requested by either Section of the Operating Committee.
3. Errors/omissions that do not affect the final TSR for the previous period or impact operations prior to issuance of the next TSR will be corrected in the subsequent TSR.
4. Errors/omissions that affect periods previously finalized and which result in a significant impact to the TSR in future periods, will be brought to the attention of the Operating Committee for resolution.

During the FRM storage evacuation period and the FRM refill period, project FRM curves will be determined by the Columbia Basin Water Management Division, Northwestern Division, U.S. Army Corps of Engineers, in accordance with the FCOP and the latest update to the “Standard Operating Procedures for Computation of Flood Control Criteria for Treaty Storage Regulation and Actual Energy Regulation Models.” These curves will be computed consistent with the timing of the TSR Schedule.

**D. In-Season FRM Deviations in the Treaty Storage Regulation Study**

In-season deviations (deviations that have not been agreed to by the CRTOC in advance) must be coordinated and agreed to by the TSR Coordination Team or CRTOC, prior to inclusion in the TSR. In the event that time constraints do not allow for such coordination and agreement, the deviation request will not be included in the TSR.

**E. Scheduling Agreements**

Unless otherwise agreed, requests by the U.S. Section of the Operating Committee for the regulation of the Canadian storage content will be made to the Canadian Section on a regular basis in accordance with the following procedures:

1. Storage Regulation
  - a) Timing: A preliminary request will be made during a weekly conference call or other agreed means not later than noon each Thursday, followed by a final agreement by

noon Friday, or by noon on the last working day of the week.

- b) Confirmation: The agreed operation will be confirmed in a Weekly Treaty Storage Operation Agreement transmitted via electronic mail on Friday, or the last working day of the week, in accordance with the following format unless otherwise agreed:

This message confirms our verbal agreement on \_\_\_\_\_ (date)  
that the \_\_\_\_\_ (storing/drafting) of an estimated \_\_\_\_\_ ksf/d \_\_\_\_\_ (in/from) the  
whole of Canadian storage for the Period \_\_\_\_\_ through \_\_\_\_\_ is consistent with the  
Detailed Operating Plan (DOP).

This agreement is based on an estimated average inflow during the above-mentioned  
period of

\_\_\_\_\_ kcfs to Duncan Reservoir,  
\_\_\_\_\_ kcfs to Libby Reservoir,  
\_\_\_\_\_ kcfs to Mica Reservoir, and  
Estimated average regulated inflow of  
\_\_\_\_\_ kcfs to Arrow Reservoir, and an  
Estimated regulated outflow of  
\_\_\_\_\_ kcfs from the Libby Project,  
That will result in average weekly Treaty discharges of  
\_\_\_\_\_ kcfs from the Duncan Project,  
\_\_\_\_\_ kcfs from the Mica Project, and  
\_\_\_\_\_ kcfs from the Arrow Project.

This operation of the whole of Canadian storage is based on the \_\_\_\_\_ (date) DOP TSR  
expected end-of-\_\_\_\_\_ (period) storage level for the whole of Canadian storage of  
\_\_\_\_\_ ksf/d.

This operation includes expected \_\_\_\_\_ (storage above/draft below) the end-of-  
\_\_\_\_\_ (period) DOP TSR level for the whole of Canadian storage of \_\_\_\_\_ ksf/d.

Treaty discharges will be made effective at the Canadian-United States border. The  
Weekly Treaty Storage Operation Agreement will be deemed to have been fulfilled if the  
total amount of Treaty water agreed to is released from Arrow plus Duncan reservoir  
provided an amount equal to or greater than the water released from Duncan reservoir is  
concurrently discharged from Kootenay Lake.

- c) SOAs and LCA/STLA: The Weekly Treaty Storage Operation Agreements shall  
indicate storage operations under any SOA or the STLA/LCA.
- d) Span Covered by Weekly Treaty Storage Operation Agreement: The span covered by  
the agreement shall be from Saturday following the date of the weekly request to the  
following Friday.
- e) Release Determination: The amount of water released or stored during the span of  
the Weekly Treaty Operation Storage Agreement will be determined by the changes  
in reservoir contents based on the recorded reservoir elevation and storage capacity  
tables for Duncan (Exhibit 10), Arrow (Exhibit 11), and Mica (Exhibit 12). The  
change in Arrow storage content will be determined using the recorded reservoir  
elevation at the gauge near Fauquier, B.C.
- f) Modification: If any modification to a written Weekly Treaty Storage Operation  
Agreement is agreed to by the Operating Committee, a further written Storage  
Agreement superseding the original will be dispatched immediately by the U.S.  
Section of the Operating Committee to the Canadian Section of the Operating



Committee. In accordance with Section 12 of the LCA, during the 2018-19 Operating Year, the Canadian Section shall implement at the request of the U.S. Section, up to five (5) mid-week requests for changes to the Canadian storage operation, consistent with this DOP, STLA and operating agreements entered into pursuant to this DOP. In addition, upon receipt of the preliminary weekly request each Thursday, the Canadian Section may request a modification to the current week's Treaty Storage Operation as may be necessary to meet flow ramping and fish salvage requirements in transitioning project releases from one Treaty week into the next, subject to agreement by the U.S. Section.

- g) Provisional Arrow Operation: A preliminary request by the Canadian Section for provisional operation at Arrow reservoir, in accordance with Section 6 of the STLA, shall be made concurrent with the preliminary flow request. Any Arrow provisional request will be confirmed not later than 12:00 pm on Thursday (or earlier if needed to meet the Western Electricity Coordinating Council (WECC) holiday prescheduling calendar in accordance with the STLA Exhibit C), and subsequently documented in the Weekly Treaty Storage Operation Agreement.
- h) Non-routine Operation: Any special operation that is agreed to by the Operating Committee will be suitably documented.

2. Storage Regulation during FRM

- a) Forecasts: Daily time-step streamflow forecasts will be accomplished by use of computer simulation by the National Weather Service River Forecast Center. The regulation center required by the FCOP for the flood regulation will be located in the Columbia Basin Water Management Division, Northwestern Division, U.S. Army Corps of Engineers' offices in Portland, Oregon.
- b) Requests for Project Outflows: Pursuant to the operating rules in the FCOP, the outflows from individual Canadian storage projects may be specified, as outlined in the FCOP. Requests will be coordinated by telephone daily or on an as-needed basis, by conference calls between members of the Operating Committee or their representatives. The requests will normally prescribe the requested outflows as a mean daily discharge in cubic feet per second, for the 24-hour period from noon to noon of each day. Requests for project outflows will be determined by methods as agreed upon, and documented with a confirmation agreement by a message transmitted via e-mail from the Corps of Engineers, in Portland, Oregon. The Canadian Section of the Operating Committee or their representative will make acknowledgment of this agreement via e-mail. Any modification of the documented daily request shall be agreed by the Operating Committee before being put into effect, and shall be documented immediately using the procedure described above.
- c) Regulation during Winter Floods: Daily requests for outflows from Canadian projects are normally limited to the FRM refill period. During the occurrence of winter floods (periods of high winter flows) in the Lower Columbia River, if a special regulation of Arrow storage becomes necessary to preserve the natural FRM storage effect, then the outflows from Arrow will be regulated on a day-to-day basis by agreement of the Operating Committee in accordance with the requests of the U.S. Section of the Operating Committee. Insofar as is possible, the outflows from Arrow will not exceed the calculated natural lake outflows until the space obligated for this purpose as shown on Chart 5 of the FCOP is filled. The requests for such

regulation will be in accordance with procedures described above. If, as a result of operation for winter FRM, a reservoir ends up above its FRM rule curve, then an appropriate outflow schedule for that reservoir will be determined to ensure that the reservoir will be drafted to its FRM rule curve as soon as feasible.

## **VI. OPERATING GUIDES**

### **A. Operating Rule Curve (ORC)**

The ORC for the whole of Canadian storage shall be the sum of the ORCs for each of Mica, Arrow, and Duncan. The ORC for each of the Mica, Arrow, and Duncan Reservoirs during the period 1 August 2018 through 31 July 2019 is determined in accordance with the reference documents of Section I, and is defined as follows:

1. During the period 1 August 2018 through 31 December 2018, the ORC is the higher of the First Critical Rule Curve or the Assured Refill Curve.
2. During the period 1 January 2019 through 31 July 2019, the ORC is the higher of the First Critical Rule Curve or the Assured Refill Curve, unless the Variable Refill Curve (VRC) is below the higher of the above two curves (but no lower than the VRCLL), then it is defined by the VRC.
3. During the period 1 January 2019 through 15 April 2019, the ORC will not be lower than the Operating Rule Curve Lower Limit, designed to protect firm loads with recurrence of 1936-37 hydro conditions, unless a lower reservoir elevation is required for FRM (Exhibit 3).
4. During any month in the Operating Year, the ORC will not be higher than the FRM Rule Curve, defined as the maximum elevation of each reservoir established by FRM requirements and may be modified on mutual agreement for construction and other contingency requirements.
5. Operation of Mica will be in accordance with the Mica Project Operating Criteria (Table 2) tabulated with specified qualifications in subsection VII(C). Differences between Mica's storage operation and its ORC (or Proportional Draft Point (PDP) if different) shall be balanced with equal and opposite changes to Arrow's ORC (or PDP) to the extent possible within agreed Operating Limits (as described in subsection VII(B)). The obligation to operate Mica and Arrow to produce optimum benefits in Canada and downstream in the United States will be deemed to have been fulfilled by operating to these criteria.
6. The Variable Refill Curves (VRCs) for Mica, Arrow, and Duncan shall be constructed based on procedures and power discharge requirements as specified in Exhibit 4.

### **B. Rule Curves and Operating Data**

Rule Curves and operating data are shown as follows:

- |   |           |
|---|-----------|
| 1. Assured Refill Curves for Mica, Arrow, and Duncan.   | Exhibit 1 |
| 2. Critical Rule Curves for Mica, Arrow, Duncan, and the whole of Canadian storage.                 | Exhibit 2 |
| 3. Operating Rule Curve Lower Limits for Mica, Arrow, and Duncan based on 1936-37 Hydro Conditions. | Exhibit 3 |

- |    |  |           |
|----|--|-----------|
| 4. | Variable Refill Curve Procedures, including Power Discharge Requirements for January – July Volume Runoff of the Columbia River at The Dalles, Oregon for Mica, Arrow, and Duncan. | Exhibit 4 |
| 5. | Coordinated System Loads and Resources Used in AOP19.  | Exhibit 5 |
| 6. | U.S. TSR Critical Rule Curves and ARCs.  | Exhibit 6 |
| 7. | U.S. Power Discharge Requirements (PDRs) and VRC Lower Limits (VRCLLs).  | Exhibit 7 |
| 8. | U.S. Operating Rule Curve Lower Limits based on 1936-37 Hydro Conditions.  | Exhibit 8 |
| 9. | Composite Canadian Storage Contents from the DOP19 80-Year Continuous TSR hydroregulation study.   | Exhibit 9 |

**C. Reservoir Storage/Elevation Tables**

The following tables shall be considered to be the official storage for the projects:

- |    |  |            |
|----|--|------------|
| 1. | Duncan Reservoir Storage/Elevation Table<br>(Dated 21 February 1973; Updated 1 February 2013). | Exhibit 10 |
| 2. | Arrow Reservoir Storage/Elevation Table<br>(Dated 28 February 1974; Updated 1 February 2013).  | Exhibit 11 |
| 3. | Mica Reservoir Storage/Elevation Table<br>(Dated 25 March 1974; Updated 1 February 2013).      | Exhibit 12 |

**VII. OPERATING LIMITS**

**A. Duncan Project**

1. Maximum outflow is limited to physical capability in actual operation; however, in the TSR, it is limited to 10,000 cfs in each period.
2. Minimum average weekly outflow is 100 cfs.
3. Maximum rate of change in outflow is normally 4,000 cfs per day unless a larger change is necessary to accomplish the objectives of the FCOP.
4. Normal full pool elevation is 1,892.0 feet.
5. Normal minimum pool elevation is 1,794.2 feet.
6. Normal maximum reservoir average monthly draft rate in elevation during any period is limited to 1 foot per day.

**B. Arrow Project**

1. In actual operation, Arrow maximum outflow is limited to physical capability, except during January when the Entities agree to continue the LCA Attachment C limit of

80,000 cfs. This January outflow limit applies to average weekly flows and may be exceeded if otherwise agreed or higher outflows are needed to meet FRM requirements or compensate for Duncan underruns.

2. Minimum average weekly outflow is 5,000 cfs.
3. Maximum rate of change in outflow is normally 15,000 cfs per day unless a larger change is necessary to accomplish the objectives of the FCOP.
4. Normal full pool elevation is 1,444.0 feet as measured at the Fauquier gauge.
5. Normal minimum pool elevation is 1,377.9 feet.
6. Normal maximum reservoir average monthly draft rate in elevation during any period is limited to 1 foot per day.
7. The Arrow reservoir storage operation in the TSR will be limited by a maximum outflow, minimum outflow, or a maximum storage level as defined by the Arrow Project Operating Criteria (APOC) from AOP22, as shown in Table 1. The APOC includes the following:
  - a) Arrow's outflows will be limited, under all water conditions, to a maximum monthly outflow of 70,000 cfs in January and 60,000 cfs in February, subject to FRM requirements.
  - b) Arrow's minimum outflow is set to 10,000 cfs from July through January. From February through June, Arrow's minimum outflow is calculated on a sliding scale and is dependent upon the forecast of the unregulated runoff at The Dalles (TDA), Oregon. For the periods of February and March, the sliding scale is based upon TDA January through July Forecasted Runoff. For the period ending April 15<sup>th</sup> through June, the sliding scale is based upon TDA April through July Forecasted Runoff. The minimum period outflows will be decreased to as low as 5,000 cfs (Treaty minimum) to prevent the combined draft of Mica and Arrow from exceeding 14.1 Maf.
  - c) Arrow's maximum storage contents are set to either a specific level, as in the case of all periods from July through January (set to URC), or are calculated on a sliding scale in relationship to the forecast of the unregulated runoff at TDA. The calculation of each period's maximum storage content is similar to those described for Arrow's minimum outflow, as listed in part 7b), above.

**Table 1 – Arrow Project Operating Criteria (APOC)<sup>1/</sup>**

Period	Volume Runoff Period	The Dalles Volume Runoff (Maf)	Maximum Storage Limit 2/ 3/ (ksfd)	Minimum Outflow Limit 3/ 4/ (cfs)	Maximum Outflow Limit 5/ (cfs)
August 15 - December	-		URC	10,000	-
January	-		URC	10,000	70,000
February	Jan-Jul	≤ 90 >90 to <100 ≥ 100	URC to 1,500.0 1,500.0	10,000 to 20,000 20,000	60,000
March	Jan-Jul	≤ 90 >90 to <100 ≥ 100	URC to 1,200.0 1,200.0	10,000 to 20,000 20,000	-
April 15	Apr-Jul	≤ 70 >70 to <80 ≥ 80	URC to 900.0 900.0	10,000 to 15,000 15,000	-
April 30	Apr-Jul	≤ 70 >70 to <80 ≥ 80	URC to 1,000.0 1,000.0	10,000 to 15,000 15,000	-
May	Apr-Jul	≤ 70 >70 to <80 ≥ 80	URC to 2,600.0 2,600.0	5,000 to 10,000 10,000	-
June	Apr-Jul	≤ 70 >70 to <80 ≥ 80	URC to 3,300.0 3,300.0	5,000 to 10,000 10,000	-
July	-		URC	10,000	-

Source: Arrow Project Operating Criteria from the AOP22.

**Notes:**

1. All APOC limits apply to the TSR study only.
2. If the Maximum Storage Limit is computed to be above the URC, then the URC will apply.
3. Interpolate if The Dalles volume runoff is between the two threshold values. For example, for February, if the Jan-Jul volume runoff is between 90 Maf and 100 Maf, then the February Maximum Storage Limit is interpolated between February's URC and 1,500.0 ksfd, and the Minimum Outflow Limit is interpolated between 10,000 cfs and 20,000 cfs.
4. The Minimum Average Period Outflow Limit is an operating limit and may be reduced to as low as 5,000 cfs (Treaty minimum) to avoid drafting Mica+Arrow storage beyond 14.1 Maf.
5. The Maximum Average Period Outflow Limit applies over all water conditions and takes precedence over the Maximum Storage Limit. However, the Maximum Outflow Limit may be exceeded to avoid storage above the URC.

**C. Mica Project**

The Mica Project Treaty storage operation in the TSR will be according to the Mica Project Operating Criteria shown in Table 2 except as qualified in subsections VII(C)1 through VII(C)6.

1. VRCs shall be constructed according to Exhibit 4 with the 31 July Treaty storage content of 3,529.2 ksfd. However, the Operating Committee may agree to set Mica's VRC July refill target equal to the Mica Target End-of-Period Treaty Storage Content of 3,374.1 ksfd indicated on the following "Mica Project Operating Criteria" table.
2. Mica project operation will be determined by the End-of-Previous-Period Arrow Storage Content as shown in Table 2, except for the limitations or changes required by subsections VII(C)3 through VII(C)6. The End-of-Previous-Period Arrow Storage Content shall be determined from the current TSR study. Mica's target operation will be defined either by a Target End-of-Period Treaty Storage Content or a Target Period Average Outflow.
3. Mica operation to the Target End-of-Period Treaty Storage Contents shall be limited by the Period Minimum and Period Maximum Outflows shown in Table 2, unless needed to accomplish the objectives of the FCOP.
4. Mica operation to the Target Period Average Outflow shall be limited by the End-of-Period Minimum Treaty Storage Content shown in Table 2. Mica outflows shall be reduced as required down to a lower limit of the Period Minimum Outflow shown in Table 2, to prevent draft below the End-of-Period Minimum Treaty Storage Content. Project Minimum Outflow may cause the reservoir to draft below the Treaty Minimum Storage Content.
5. Mica outflows will be increased during the periods October through July as required to avoid violation of the FRM Rule Curve.
6. Treaty storage releases from Mica in excess of 7 Maf that result from operating Mica under the criteria described in VII(C)2 through VII(C)5 above will be retained in the Arrow reservoir, subject to FRM and minimum flow requirements at Arrow, and Mica will be reduced to Project Minimum Outflow as required to minimize releases in excess of 7 Maf. The total combined storage draft from Mica and Arrow will not exceed 14.1 Maf unless FRM or minimum flow criteria at Arrow will not permit the excess Mica storage releases to be retained at Arrow. If such a release should occur, the target Mica operation will remain as specified in Mica Project Operating Criteria, and the excess release will be returned as soon as the operating criteria permit.

Table 2 – Mica Project Operating Criteria (MPOC)

Period	End of Previous Period Arrow Storage Content (KSFD)	Target Operation		Target Operation Limits		
		Period Average Outflow (CFS)	End-of-Period Storage Content 1/ (KSFD)	Minimum Target Treaty Storage Content 2/ (KSFD)	Maximum Outflow 1/ (CFS)	Minimum Outflow 3/ (CFS)
August 1-15	3,570 - FULL	-	3,494.1	-	54,000	15,000
	3,200 - 3,570	25,000	-	0	-	15,000
	2,100 - 3,200	27,000	-	0	-	15,000
	0 - 2,100	44,000	-	0	-	15,000
August 16-31	3,530 - FULL	-	3,529.2	-	54,000	15,000
	3,280 - 3,530	32,000	-	0	-	15,000
	2,700 - 3,280	40,000	-	0	-	15,000
	0 - 2,700	44,000	-	0	-	15,000
September	3,570 - FULL	-	3,454.1	-	54,000	10,000
	1,730 - 3,570	27,000	-	0	-	10,000
	1,640 - 1,730	32,000	-	0	-	10,000
	0 - 1,640	36,000	-	0	-	10,000
October	3,060 - FULL	-	3,394.1	-	54,000	10,000
	2,500 - 3,060	14,000	-	0	-	10,000
	1,410 - 2,500	19,000	-	0	-	10,000
	0 - 1,410	21,000	-	0	-	10,000
November	3,040 - FULL	16,000	-	0	-	12,000
	2,980 - 3,040	23,000	-	0	-	12,000
	2,960 - 2,980	30,000	-	0	-	12,000
	0 - 2,960	32,000	-	0	-	12,000
December	2,670 - FULL	28,000	-	204.1	-	14,000
	2,570 - 2,670	31,000	-	204.1	-	14,000
	2,200 - 2,570	32,000	-	204.1	-	14,000
	0 - 2,200	34,000	-	204.1	-	14,000
January	1,830 - FULL	28,000	-	204.1	-	14,000
	1,800 - 1,830	36,000	-	204.1	-	14,000
	0 - 1,800	44,000	-	204.1	-	14,000
February	1,170 - FULL	24,000	-	0	-	12,000
	600 - 1,170	31,000	-	0	-	12,000
	0 - 600	36,000	-	0	-	12,000
March	880 - FULL	10,000	-	0	-	12,000
	320 - 880	12,000	-	0	-	12,000
	250 - 320	14,000	-	0	-	12,000
	0 - 250	26,000	-	0	-	12,000
April 1-15	600 - FULL	10,000	-	0	-	12,000
	200 - 600	12,000	-	0	-	12,000
	50 - 200	14,000	-	0	-	12,000
	0 - 50	26,000	-	0	-	12,000
April 16-30	290 - FULL	10,000	-	0	-	10,000
	80 - 290	14,000	-	0	-	10,000
	0 - 80	18,000	-	0	-	10,000
May	150 - FULL	8,000	-	0	-	8,000
	70 - 150	14,000	-	0	-	8,000
	0 - 70	21,000	-	0	-	8,000
June	1,370 - FULL	8,000	-	0	-	8,000
	1,100 - 1,370	10,000	-	0	-	8,000
	970 - 1,100	13,000	-	0	-	8,000
	0 - 970	16,000	-	0	-	8,000
July	3,360 - FULL	-	3,374.1	-	54,000	10,000
	2,400 - 3,360	10,000	-	0	-	10,000
	2,200 - 2,400	20,000	-	0	-	10,000
	0 - 2,200	32,000	-	0	-	10,000

Source: Mica Project Operating Criteria from the AOP22.

Notes:

- 1/ If the Mica Target End-of-Period Treaty Storage Content is less than 3,529.2 ksfd, then a Period Maximum Outflow of 54,000 cfs will apply. These maximum flows may be exceeded for FRM.
- 2/ If a Target Period Average Outflow operation would otherwise cause Mica to violate its End-of-Period Minimum Treaty Storage Content, then Mica outflows will be reduced as needed, but not lower than the Period Minimum Outflow, in order to maintain the reservoir at the End-of-Period Minimum Treaty Storage Content, or minimize the draft below End-of-Period Minimum Treaty Storage Content.
- 3/ Period Minimum Outflow only applies if the Target Period Average Outflow operation would result in a Mica content below the End-of-Period Minimum Treaty Storage Content.

## EXHIBITS

### Exhibit 1 - Assured Refill Curves (ARC)

1/

Period	MICA						ARROW						DUNCAN					
	Inflow 1/	PDR 3/	Water Available for Refill		CRC1	ARC	1931 Inflow 1/	PDR 3/	Water Available for Refill		MICA Refill 2/	ARC	1931 Inflow	PDR 3/	Water Available for Refill		ARC	
	(cfs)	(cfs)	(cfs)	(ksfd)	(ksfd)	(ksfd)	(cfs)	(cfs)	(cfs)	(ksfd)	(ksfd)	(ksfd)	(cfs)	(cfs)	(cfs)	(ksfd)	(ksfd)	
AG1	52,256	3,000	49,256	738.8	3,529.2	0.0	81,791	5,000	76,791	1,151.9	3,529.2	0.0	5,228	100	5,128	76.9	0.0	
AG2	39,483	3,000	36,483	583.7	3,529.2	0.0	61,808	5,000	56,808	908.9	0.0	0.0	3,875	100	3,775	60.4	0.0	
SEP	23,088	3,000	20,088	602.6	3,361.5	589.3	38,819	5,000	33,819	1,014.6	-167.7	0.0	2,310	100	2,210	66.3	1.3	
OCT	8,755	3,000	5,755	178.4	3,067.0	767.7	14,417	5,000	9,417	291.9	-294.5	0.0	1,089	100	989	30.7	32.0	
NOV	5,167	3,000	2,167	65.0	2,614.2	832.7	9,356	5,000	4,356	130.7	-452.8	0.0	684	100	584	17.5	49.5	
DEC	3,525	3,000	525	16.3	1,489.2	848.9	6,470	5,000	1,470	45.6	-1,125.0	0.0	461	100	361	11.2	60.7	
JAN	2,828	3,000	-172	-5.3	958.8	843.6	6,442	5,000	1,442	44.7	-530.4	514.0	428	100	328	10.2	70.9	
FEB	2,584	3,000	-416	-11.6	783.8	832.0	5,751	5,000	751	21.0	-126.8	661.8	428	100	328	9.2	80.1	
MAR	3,214	3,000	214	6.6	788.1	838.6	7,842	5,000	2,842	88.1	6.6	743.3	554	100	454	14.1	94.2	
AP1	4,669	3,000	1,669	25.0	775.8	863.7	12,052	5,000	7,052	105.8	25.0	824.0	825	100	725	10.9	105.0	
AP2	7,221	3,000	4,221	63.3	384.1	927.0	20,475	5,000	15,475	232.1	63.3	992.8	1,137	100	1,037	15.6	120.6	
MAY	28,098	9,600	18,498	573.5	685.5	1,500.4	69,119	9,500	59,619	1,848.2	573.5	2,267.6	5,170	100	5,070	157.2	277.8	
JUN	60,185	20,000	40,185	1,205.6	2,332.8	2,706.0	114,506	33,000	81,506	2,445.2	1,205.6	3,507.2	8,030	500	7,530	225.9	503.7	
JUL	56,556	30,000	26,556	823.2	3,429.1	3,529.2	88,892	60,000	28,892	895.6	823.2	3,579.6	7,320	800	6,520	202.1	705.8	

Notes on Exhibit 1:

- 1/ The Assured Refill Curve (ARC) indicates the end-of-period storage content required to assure refill of Canadian storage by 31 July based on 1931 historical monthly inflow. The period inflow at each reservoir, based on the 2010 Level Modified streamflow record, is reduced by deducting the Power Discharge Requirements (PDR) and water required for refill, if any, at upstream reservoirs. The Entities may agree to revise the data upon the completion of the Refill Study by the Operating Committee.
- 2/ Arrow's upstream refill requirement (at Mica) is calculated by subtracting the previous period's higher value of either Mica's ARC or Mica's first year critical rule curve (CRC1) from the higher of those two respective values for the current period. An exception occurs in July, where Mica's July values are set to full. In July, then, the previous period's higher value of Mica's ARC or CRC1 is subtracted from full. CRC1 is also shown in Exhibit 2.
- 3/ PDRs are from the AOP19.



**Exhibit 2 - Critical Rule Curves (CRC)**

End-of-Period Usable Storage Content (ksfd)

YEAR	AUG15	AUG31	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR15	APR30	MAY	JUN	JUL
							MICA							
CRC1	3,529.2	3,529.2	3,361.5	3,067.0	2,614.2	1,489.2	958.8	783.8	788.1	775.8	384.1	685.5	2,332.8	3,429.1
CRC2	3,529.2	3,520.6	3,275.7	2,984.9	2,358.8	1,775.8	607.2	40.8	0.0	0.0	219.4	870.4	2,371.2	3,324.1
CRC3	3,529.2	3,529.2	3,369.1	3,057.5	2,496.6	1,665.1	770.2	187.1	0.0	0.0	0.0	673.2	2,034.2	2,553.7
CRC4	2,582.1	2,536.1	2,089.1	1,648.9	1,121.9	253.7	0.0	0.0						
							ARROW							
CRC1	3,579.6	3,579.6	3,513.0	3,571.7	3,484.4	3,497.7	2,190.0	831.7	410.7	315.2	746.8	1,824.6	3,363.4	3,522.7
CRC2	3,579.1	3,499.9	2,950.2	2,296.8	1,756.8	1,283.9	513.5	88.8	0.0	104.9	453.6	1,551.2	2,653.4	3,258.1
CRC3	3,378.9	3,466.4	3,179.6	2,686.6	1,981.7	1,450.4	679.6	114.2	0.0	0.0	0.1	768.8	1,837.0	2,133.4
CRC4	1,821.1	1,627.8	1,414.4	1,114.9	318.4	0.0	0.0	0.0						
							DUNCAN							
CRC1	705.8	705.8	625.0	600.0	550.0	450.0	250.0	93.0	102.0	107.5	118.8	236.3	511.1	698.0
CRC2	700.0	675.0	550.0	500.0	450.0	300.0	100.0	75.0	0.0	13.4	46.5	161.5	381.1	550.0
CRC3	600.0	600.0	525.0	450.0	400.0	200.0	75.0	25.0	0.0	4.8	0.0	157.2	395.1	500.0
CRC4	550.0	550.0	450.0	350.0	150.0	0.0	0.0	0.0						
							COMPOSITE							
CRC1	7,814.6	7,814.6	7,499.5	7,238.7	6,648.6	5,436.9	3,398.8	1,708.5	1,300.8	1,198.5	1,249.7	2,746.4	6,207.3	7,649.8
CRC2	7,808.3	7,695.5	6,775.9	5,781.7	4,565.6	3,359.7	1,220.7	204.6	0.0	118.3	719.5	2,583.1	5,405.7	7,132.2
CRC3	7,508.1	7,595.6	7,073.7	6,194.1	4,878.3	3,315.5	1,524.8	326.3	0.0	4.8	0.1	1,599.2	4,266.3	5,187.1
CRC4	4,953.2	4,713.9	3,953.5	3,113.8	1,590.3	253.7	0.0	0.0						

Source: Critical Rule Curves are from the AOP19.

**Exhibit 3 - Operating Rule Curve Lower Limits (ORCLL)**

End-of-Period Usable Storage Content (ksfd)

Period	Mica	Arrow	Duncan
JAN	421.6	411.3	11.8
FEB	22.5	37.5	6.3
MAR	0.0	0.0	0.0
AP1	0.0	0.0	0.0

Source: Operating Rule Curve Lower Limits are from the AOP19.

### Exhibit 4 - Variable Refill Curve (VRC) Procedures

The Variable Refill Curves (VRCs) indicate the end-of-period storage content required to refill Canadian storage based on forecasts of unregulated inflow volume. The probable forecast volume at each reservoir is reduced by deducting the 95 percent confidence forecast error, Power Discharge Requirements (PDRs), and water required for refill at upstream reservoirs based on the Operating Rule Curves (ORCs).

**POWER DISCHARGE REQUIREMENTS (CFS)  
FOR JANUARY - JULY VOLUME RUNOFF  
OF THE COLUMBIA RIVER AT THE DALLES, OREGON**

<b>Project</b>	<b>Jan</b>	<b>Feb</b>	<b>Mar</b>	<b>Apr</b>	<b>May</b>	<b>Jun</b>	<b>Jul</b>
<b>Mica</b>							
ARC PDRs	3,000	3,000	3,000	3,000	3,000	9,600	30,000
80 MAF PDRs	3,000	3,000	3,000	3,000	3,000	3,000	27,200
95 MAF PDRs	3,000	3,000	3,000	3,000	3,000	3,000	23,000
110 MAF PDRs	3,000	3,000	3,000	3,000	3,000	3,000	23,000
<b>Arrow</b>							
ARC PDRs	5,000	5,000	5,000	5,000	5,000	9,500	60,000
80 MAF PDRs	5,000	5,000	5,000	5,000	5,000	5,000	50,000
95 MAF PDRs	5,000	5,000	5,000	5,000	5,000	5,000	50,000
110 MAF PDRs	5,000	5,000	5,000	5,000	5,000	5,000	50,000
<b>Duncan</b>							
ARC PDRs	100	100	100	100	100	500	800
80 MAF PDRs	100	100	100	100	100	1,800	2,500
95 MAF PDRs	100	100	100	100	100	1,800	2,500
110 MAF PDRs	100	100	100	100	100	1,800	2,500

**Notes:**

- (1) If the forecasted natural January through July volume runoff at The Dalles is less than 80 Maf, the Power Discharge Requirement in the 80 Maf schedule will be used. For intermediate forecasted volumes, the Power Discharge Requirement will be interpolated linearly between the values shown above.
- (2) PDRs are from the AOP19.
- (3) Distribution factors and forecast errors are shown in Appendix 8 of the 2003 POP, as revised by the Operating Committee.

**Exhibit 5 - Coordinated System Loads and Resources Used in AOP19**

Energy (aMW)

<b>Period</b>	<b>PNW Area Firm Loads 1/</b>	<b>Export, Imports and Resources 2/</b>	<b>Coordinated Hydro Load 3/</b>
<b>AG1</b>	<b>23,360</b>	<b>11,332</b>	<b>12,028</b>
<b>AG2</b>	<b>23,350</b>	<b>11,951</b>	<b>11,399</b>
<b>SEP</b>	<b>21,596</b>	<b>11,389</b>	<b>10,207</b>
<b>OCT</b>	<b>20,774</b>	<b>11,541</b>	<b>9,233</b>
<b>NOV</b>	<b>23,239</b>	<b>11,805</b>	<b>11,434</b>
<b>DEC</b>	<b>25,509</b>	<b>11,986</b>	<b>13,523</b>
<b>JAN</b>	<b>25,800</b>	<b>11,938</b>	<b>13,862</b>
<b>FEB</b>	<b>24,521</b>	<b>11,515</b>	<b>13,006</b>
<b>MAR</b>	<b>22,522</b>	<b>11,258</b>	<b>11,264</b>
<b>AP1</b>	<b>21,540</b>	<b>11,957</b>	<b>9,583</b>
<b>AP2</b>	<b>21,577</b>	<b>10,893</b>	<b>10,684</b>
<b>MAY</b>	<b>20,939</b>	<b>8,595</b>	<b>12,344</b>
<b>JUN</b>	<b>22,642</b>	<b>11,328</b>	<b>11,314</b>
<b>JUL</b>	<b>24,134</b>	<b>11,878</b>	<b>12,256</b>

Notes: Data for columns 1, 2, and 3 are from DDPB Table 1A of the AOP19. References to line numbers in the notes below are references to lines in DDPB Table 1A of the AOP19.

- 1/ The Pacific Northwest Area Firm Load including pumping, but excluding Utah Power and Light loads in Idaho (line 1d).
- 2/ Equals the total power flows out (line 2k), plus the total load served by flows-in (line 3i), plus the load served by other resources (line 4f minus line 4b), minus the total thermal installations (line 6c), minus the hydro maintenance (line 8a), and minus the transmission system losses (line 8b). Other resources include hydro independents (1929 for example) that will be updated as described in subsection II(D)2.
- 3/ AOP19 Coordinated Hydro Model Load, DDPB Table 1A, line 10.

## Exhibit 6 – U.S. TSR Critical Rule Curves and ARCs

End-of-Period Usable Storage Content (ksfd)

Unadjusted for Crossovers

YEAR	AUG15	AUG31	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR15	APR30	MAY	JUN	JUL
<b>LIBBY</b>														
ARC	1767.7	1818.3	1853.0	1848.9	1820.0	1768.6	1717.6	1665.2	1612.5	1597.3	1595.1	1989.4	2420.0	2510.5
CRC1	2510.5	2510.5	2470.4	2510.5	2212.1	1502.2	1446.0	1216.5	1170.9	1148.5	1056.5	1537.8	2510.5	2510.5
CRC2	2510.5	2510.5	2510.5	2495.4	2215.4	1502.2	1075.9	980.2	685.2	725.6	879.1	1358.5	2254.6	2510.5
CRC3	2510.5	2510.5	2510.5	2506.5	2220.4	1502.2	1056.0	585.0	326.7	311.5	309.3	765.6	1316.2	1530.7
CRC4	1564.1	1578.9	1590.1	1565.0	1524.7	824.6	246.0	0.0						
<b>CORRA LINN</b>														
ARC	57.6	57.6	57.6	57.6	57.6	57.6	57.6	57.6	57.6	57.6	57.6	57.6	57.6	285.4
CRC1	285.4	285.4	396.9	396.9	396.9	396.9	322.8	234.8	69.8	69.8	69.8	69.8	285.4	285.4
CRC2	285.4	285.4	396.9	396.9	396.9	396.9	322.8	234.8	69.8	69.8	69.8	69.8	285.4	285.4
CRC3	285.4	285.4	396.9	396.9	396.9	396.9	322.8	234.8	69.8	69.8	69.8	69.8	285.4	285.4
CRC4	285.4	285.4	396.9	396.9	396.9	396.9	322.8	57.6						
<b>HUNGRY HORSE</b>														
ARC	920.8	923.4	926.0	942.2	960.3	971.4	980.5	990.4	1015.2	1047.5	1097.8	1402.0	1503.4	1503.4
CRC1	1503.4	1476.2	1290.0	1306.0	1125.9	941.4	817.4	813.0	819.4	826.1	870.6	1196.7	1503.4	1503.4
CRC2	1418.6	1333.0	1250.0	1210.6	937.3	654.4	369.5	373.3	375.5	466.3	618.1	890.5	1084.0	1130.0
CRC3	1015.0	922.5	758.0	750.0	635.6	364.6	91.6	45.0	59.2	91.5	146.3	500.0	658.4	520.0
CRC4	430.0	321.0	197.0	180.0	175.0	11.1	0.0	0.0						
<b>KERR</b>														
ARC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	102.9	516.4	614.7
CRC1	614.7	614.7	614.7	614.7	600.0	480.0	282.4	0.0	0.0	0.0	17.9	426.3	614.7	614.7
CRC2	614.7	614.7	614.7	614.7	614.7	588.5	522.8	315.0	0.0	0.0	261.6	426.3	614.7	614.7
CRC3	614.7	614.7	614.7	614.7	614.7	564.8	516.8	289.4	0.0	0.0	22.0	426.3	614.7	614.7
CRC4	614.7	614.7	614.7	517.2	357.2	205.8	33.8	0.0						
<b>ALBENI FALLS</b>														
ARC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	404.8	582.4
CRC1	582.4	582.4	465.7	190.4	57.6	57.6	57.6	57.6	57.6	57.6	190.4	279.0	582.4	582.4
CRC2	582.4	582.4	465.7	190.4	57.6	57.6	57.6	57.6	57.6	57.6	190.4	279.0	582.4	582.4
CRC3	582.4	582.4	465.7	190.4	57.6	57.6	57.6	57.6	57.6	57.6	190.4	279.0	582.4	582.4
CRC4	582.4	582.4	465.7	190.4	57.6	57.6	57.6	0.0						
<b>GRAND COULEE</b>														
ARC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7	0.0	0.0	596.3	2697.1
CRC1	2697.1	2614.7	2614.7	2614.7	2614.7	2573.5	2573.5	2546.5	1639.3	1175.8	597.0	966.2	2697.1	2697.1
CRC2	2697.1	2614.7	2614.7	2614.7	2614.7	2573.5	2573.5	2573.5	2294.7	2215.9	2375.7	2375.7	2697.1	2697.1
CRC3	2697.1	2614.7	2614.7	2614.7	2614.7	2573.5	2573.5	2573.5	2426.4	2426.4	2091.9	2697.1	2697.1	2697.1
CRC4	2697.1	2614.7	2614.7	2614.7	2614.7	2534.1	1102.1	0.0						
<b>CHELAN</b>														
ARC	0.0	1.2	19.5	31.8	43.5	53.3	65.8	76.2	94.3	105.7	134.0	272.1	339.8	341.5
CRC1	341.5	341.5	331.8	295.8	246.1	196.0	144.4	97.1	108.0	113.3	98.4	211.2	341.4	341.5
CRC2	341.4	341.2	308.5	259.4	207.0	154.7	95.5	53.1	14.6	48.6	98.6	191.4	294.9	341.5
CRC3	334.4	316.3	308.5	258.7	210.4	158.2	108.9	63.6	20.3	1.9	0.5	161.9	282.0	283.9
CRC4	269.0	250.4	213.9	165.6	120.6	70.0	20.8	0.0						
<b>BROWNLEE</b>														
ARC	0.0	0.0	0.0	0.0	0.0	6.8	124.9	210.3	384.3	422.0	459.8	491.7	491.7	491.7
CRC1	477.8	477.8	474.8	477.8	462.6	434.2	351.1	327.1	276.1	292.5	320.2	411.2	484.8	477.8
CRC2	477.8	477.8	474.8	477.8	462.6	434.2	351.1	327.1	276.1	292.5	320.2	411.2	484.8	477.8
CRC3	477.8	477.8	474.8	477.8	462.6	434.2	351.1	327.1	276.1	292.5	320.2	364.7	331.0	272.3
CRC4	253.6	233.4	211.9	301.7	430.9	434.2	351.1	0.0						
<b>DWORSHAK</b>														
ARC	269.0	258.1	240.5	235.3	238.5	225.4	224.9	232.0	335.1	474.5	579.3	940.6	1016.0	1016.0
CRC1	652.6	497.0	390.7	388.1	381.3	365.9	345.8	329.3	368.4	388.3	492.9	884.9	1016.0	780.9
CRC2	652.6	497.0	390.7	375.5	352.2	357.6	336.0	377.9	460.7	639.4	824.7	993.1	1016.0	780.9
CRC3	652.6	497.0	390.7	385.4	388.6	375.5	375.1	382.2	485.2	624.7	729.4	1016.0	1016.0	780.9
CRC4	652.6	497.0	390.7	372.6	362.8	353.2	344.0	0.0						

**Exhibit 6 – U.S. TSR Critical Rule Curves  
and ARCs (Continued)**  
**End-of-Period Usable Storage Content (ksfd)**  
Unadjusted for Crossovers

YEAR	AUG15	AUG31	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR15	APR30	MAY	JUN	JUL
<b>NOXON</b>														
ARC	89.5	89.5	89.5	89.5	89.5	89.5	89.5	89.5	89.5	89.5	89.5	89.5	89.5	116.3
CRC1	116.3	116.3	116.3	116.3	112.3	112.3	112.3	100.8	89.5	89.5	116.3	116.3	116.3	116.3
<b>PRIEST LAKE</b>														
ARC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.6	35.5
CRC1	35.5	35.5	35.5	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.5	35.5	35.5
<b>CDA LAKE</b>														
ARC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.6	89.5	112.5
CRC1	112.5	112.5	92.4	68.0	0.0	0.0	0.0	0.0	0.0	0.0	90.7	97.5	112.5	112.5
<b>LONG LAKE</b>														
ARC	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	52.5
CRC1	52.5	52.5	52.5	52.5	52.5	52.5	19.8	19.8	19.8	50.2	52.5	52.5	52.5	52.5

Note: DOP19 CRC data is the same as that in the AOP19 studies with the exception of Noxon, Long Lake, and Grand Coulee. CRC data is provided here to verify the critical rule curves used in the TSR19 studies.

Both Noxon and Long Lake have updated PSMIn values of 89.5 and 19.6 ksfd, respectively. To incorporate these minimum storage values, all CRC values above the new PSMIn values remain unchanged, while all values below the new PSMIn values were raised to the new minimum values.

Grand Coulee has an updated storage vs elevation table, providing an additional 82.8 ksfd storage than used for AOP19. To incorporate the new data, all CRCs for Grand Coulee were raised by 82.8 ksfd except the CRC4 in February which remained 0.0 ksfd.

### Exhibit 7 – U.S. Power Discharge Requirements (PDRs) and VRC Lower Limits (VRCLLs)

PDR units in cfs; VRC Lower Limits units in ksfd

Project	Jan	Feb	Mar	Apr15	Apr30	May	Jun	Jul
<b>Libby</b>								
ARC PDR	4,000	4,000	4,000	4,000	4,000	6,000	8,000	8,000
80 MAF PDR	4,000	4,000	4,000	4,000	4,000	4,000	10,000	15,000
95 MAF PDR	4,000	4,000	4,000	4,000	4,000	4,000	10,000	15,000
110 MAF PDR	4,000	4,000	4,000	4,000	4,000	4,000	10,000	15,000
<b>Hungry Horse</b>								
ARC PDR	400	400	400	400	700	2,000	2,300	2,300
80 MAF PDR	400	400	400	400	400	600	2,200	3,300
95 MAF PDR	400	400	400	400	400	600	2,200	3,300
110 MAF PDR	400	400	400	400	400	600	2,200	3,300
<b>Grand Coulee *</b>								
ARC PDR	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000
80 MAF PDR	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000
95 MAF PDR	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000
110 MAF PDR	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000
80 MAF VRCLL	2,021.1	1,371.9	441.5	441.5	441.5	884.4	2,493.0	2,697.1
95 MAF VRCLL	2,021.1	1,371.9	441.5	441.5	441.5	884.4	2,493.0	2,697.1
110 MAF VRCLL	2,021.1	1,371.9	441.5	441.5	441.5	884.4	2,493.0	2,697.1
<b>Chelan</b>								
ARC PDR	50	50	50	50	50	800	1,800	1,900
80 MAF PDR	50	50	50	50	50	50	200	800
95 MAF PDR	50	50	50	50	50	50	50	50
110 MAF PDR	50	50	50	50	50	50	50	50

Notes:

1/ PDRs are from the AOP19.

2/ Distribution factors and forecast errors are shown in Appendix 8 of the 2003 POP.

\* VRCLLs are for Grand Coulee only and have been adjusted for the new Coulee storage vs elevation table.

### Exhibit 8 – U.S. Operating Rule Curve Lower Limits End-of-Period Usable Storage Content (ksfd)

Period	Libby	Hungry Horse	Grand Coulee	Chelan
JAN	748.1	91.3	2,021.1	85.3
FEB	303.9	30.4	1,371.9	36.0
MAR	38.9	8.9	196.4	2.8
AP1	0.0	0.0	0.0	0.0

Source: Operating Rule Curve Lower Limits are from the AOP19.

**Exhibit 9 - Composite Canadian Storage Contents**

From the DOP19 80-Year Continuous TSR Study; Units in ksf

<u>Water Year</u>	<u>AU1</u>	<u>AU2</u>	<u>SEP</u>	<u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>AP1</u>	<u>AP2</u>	<u>MAY</u>	<u>JUN</u>	<u>JUL</u>
1928-1929	7779.5	7809.8	7499.5	7120.6	6608.4	5162.9	3186.9	1614.2	1222.4	1195.0	1174.9	2671.6	6132.5	7481.8
1929-1930	7700.5	7655.6	6775.9	5789.3	4565.6	3278.9	1555.9	1085.0	815.6	945.2	1576.5	2971.0	5275.4	6902.1
1930-1931	7222.4	7295.5	6645.7	5767.1	4544.1	3023.6	1220.7	199.7	0.0	41.7	174.6	2182.3	4032.6	4827.4
1931-1932	4601.1	4370.2	3677.2	2923.5	1499.6	233.0	0.0	0.0	20.5	140.4	346.4	2331.8	5668.6	7566.8
1932-1933	7693.2	7814.6	6976.7	6406.1	6489.9	5162.9	3053.5	1405.5	895.7	721.0	883.7	2549.5	5710.4	7814.6
1933-1934	7779.5	7814.6	7499.5	7120.6	6617.8	5162.9	3129.7	1590.9	805.3	682.7	1284.0	3385.7	6389.9	7771.6
1934-1935	7811.3	7759.1	7006.0	6439.6	6617.8	5162.9	3063.5	1583.4	1475.6	1370.3	1501.5	2935.7	6063.0	7814.6
1935-1936	7779.5	7793.0	7447.9	6745.3	5813.6	4393.9	2209.5	1239.4	1109.4	976.8	1355.8	3653.9	6567.9	7750.6
1936-1937	7804.1	7696.9	6840.4	6004.9	4843.2	3478.0	1358.8	192.0	0.0	8.7	82.7	1575.4	4579.0	6093.5
1937-1938	6138.3	6034.2	5362.9	4767.8	4174.0	3427.9	2034.1	1539.9	1039.9	660.5	764.8	2559.2	5733.0	7673.1
1938-1939	7692.9	7656.2	7091.0	6655.5	5844.8	4802.8	2651.9	1754.2	1669.4	1775.2	2039.5	4045.8	6044.6	7814.6
1939-1940	7779.1	7752.1	7013.3	6509.5	5998.2	5162.9	3038.8	1756.7	1683.9	1687.5	1991.0	4045.8	6059.5	7246.6
1940-1941	7357.5	7325.8	6775.9	6714.0	5816.4	4609.6	3100.8	1711.3	1683.9	1795.2	2040.4	3201.0	4913.1	5859.5
1941-1942	5739.0	5632.5	5330.2	5767.6	5435.4	5044.4	3391.9	1758.7	1563.5	1115.9	1173.8	2546.5	4895.9	7341.5
1942-1943	7765.0	7777.5	7145.8	6487.1	6254.9	5162.9	3398.8	1756.7	1335.1	1166.4	1382.6	2590.4	4843.5	7477.9
1943-1944	7779.5	7814.6	7433.6	7120.6	6492.1	5162.9	3288.8	1713.0	1152.1	1194.4	1303.6	2450.8	4571.8	5243.9
1944-1945	5087.2	4898.5	4206.8	3671.6	2391.2	909.4	503.6	128.7	0.0	0.7	0.0	1829.4	4796.5	6427.6
1945-1946	6261.4	6087.4	5363.1	4711.2	3880.2	2985.7	845.1	456.8	71.9	36.7	283.8	2607.1	6071.4	7814.6
1946-1947	7779.5	7795.2	7499.5	7120.6	6617.8	5162.9	2970.8	1325.3	978.1	990.8	1386.5	3608.2	6385.0	7814.6
1947-1948	7779.5	7786.0	7499.5	7120.6	6617.8	5162.9	2997.3	1304.6	872.4	765.8	904.1	3091.5	6197.5	7814.6
1948-1949	7779.5	7814.6	7499.5	7120.6	6617.8	5162.9	3398.8	1756.7	1363.1	1362.8	1675.7	4045.8	6097.2	7386.4
1949-1950	7668.8	7621.7	6800.8	6251.1	6122.1	5162.9	2969.1	1349.3	939.5	876.2	898.8	2144.8	5497.5	7814.6
1950-1951	7779.5	7814.6	7499.5	7120.6	6617.8	5162.9	3051.2	1502.5	1095.4	1099.5	1273.8	3656.6	6504.5	7814.6
1951-1952	7779.5	7814.6	7499.5	7120.6	6617.8	5162.9	2970.2	1756.7	1309.8	1243.9	1673.8	4045.8	6522.4	7814.6
1952-1953	7779.5	7772.4	7189.4	6503.4	5524.2	4242.3	2885.5	1756.7	1234.1	828.7	853.4	2530.5	5482.5	7389.1
1953-1954	7757.6	7814.6	7499.5	7120.6	6617.8	5162.9	3029.5	1439.4	677.0	338.9	326.4	2471.2	5560.9	7814.6
1954-1955	7791.2	7814.6	7499.5	7120.6	6617.8	5162.9	3077.4	1717.2	1399.3	1357.0	1187.2	2172.4	5729.8	7814.6
1955-1956	7779.5	7814.6	7499.5	7120.6	6617.8	5162.9	3023.0	1298.3	864.6	681.1	1009.9	3300.6	6277.8	7814.6
1956-1957	7779.5	7814.6	7499.5	7120.6	6617.8	5162.9	2990.4	1379.3	979.8	945.3	1069.5	3292.9	6646.7	7814.6
1957-1958	7775.3	7698.0	7014.1	6690.3	6131.0	5162.9	3019.8	1420.2	800.0	701.2	862.6	3159.7	6420.8	7813.2
1958-1959	7775.3	7746.3	7278.7	7120.6	6617.8	5162.9	3063.9	1433.5	733.1	453.0	607.3	2675.9	5664.3	7814.6
1959-1960	7779.5	7814.6	7499.5	7120.6	6617.8	5162.9	3059.4	1474.6	1175.9	1406.1	1535.7	3008.2	5955.9	7814.6
1960-1961	7779.5	7776.3	7499.5	7120.6	6617.8	5162.9	3051.4	1478.4	720.1	602.0	658.9	2990.7	6057.0	7814.6
1961-1962	7778.9	7814.6	7311.5	7120.6	6617.8	5162.9	2985.7	1756.7	1387.1	1396.2	1640.4	3400.8	6247.7	7814.6
1962-1963	7779.5	7814.6	7499.5	7120.6	6617.8	5162.9	3050.5	1756.7	1598.7	1669.0	1952.9	3839.2	6407.1	7814.6
1963-1964	7779.5	7806.8	7499.5	7120.6	6617.8	5162.9	3027.9	1323.6	888.8	769.8	789.9	2255.0	5470.7	7814.6
1964-1965	7779.5	7814.6	7499.5	7120.6	6617.8	5162.9	3055.0	1756.7	1361.4	1335.0	1677.7	3083.5	5916.4	7814.6
1965-1966	7814.6	7814.6	7499.5	7120.6	6617.8	5162.9	3045.1	1450.1	856.6	691.0	840.0	3160.1	6014.6	7814.6
1966-1967	7779.5	7780.3	7403.6	6938.5	6617.8	5162.9	3069.8	1475.3	407.7	98.6	0.0	1776.5	4999.4	7814.6
1967-1968	7783.9	7814.6	7499.5	7120.6	6617.8	5162.9	3067.4	1478.2	926.7	632.3	460.6	2535.1	5555.6	7814.6
1968-1969	7779.5	7814.6	7499.5	7120.6	6617.8	5162.9	3033.6	1444.5	1027.8	866.7	1225.0	3555.5	6396.8	7814.6
1969-1970	7779.5	7756.4	7464.5	7120.6	6617.8	5162.9	3366.9	1763.0	1460.0	1420.1	1320.6	2720.5	6110.9	7814.6
1970-1971	7779.5	7744.8	7192.8	6787.6	6527.5	5162.9	2995.5	1587.8	1156.9	1084.8	1256.5	3645.1	6452.0	7814.6
1971-1972	7814.6	7814.6	7499.5	7120.6	6617.8	5162.9	3012.0	1327.5	661.1	408.4	186.5	1556.8	5158.1	7814.6
1972-1973	7814.6	7814.6	7499.5	7120.6	6617.8	5162.9	3398.8	1775.4	1496.5	1487.7	1619.1	3559.1	5872.5	7325.2
1973-1974	7601.0	7432.1	6756.4	6241.9	6488.4	5162.9	3051.9	1482.8	628.8	508.5	801.9	2339.4	5595.1	7814.6
1974-1975	7781.5	7814.6	7499.5	7027.1	6600.0	5162.9	3058.0	1756.7	1312.7	1199.6	1261.7	2743.2	5846.5	7814.6
1975-1976	7779.5	7814.6	7499.5	7120.6	6617.8	5162.9	3092.3	1448.8	924.4	773.3	906.8	3253.6	6129.8	7814.6
1976-1977	7814.6	7814.6	7499.5	7120.6	6570.6	5162.9	3366.6	1759.9	1307.9	1222.7	1424.0	2318.3	4046.7	4303.8
1977-1978	4129.8	4017.4	3351.7	2712.6	1484.4	1192.5	1044.4	687.7	417.7	260.1	369.3	1916.0	4782.1	6812.6
1978-1979	7203.6	7372.1	7499.5	7120.6	6617.8	5162.9	3398.8	1767.6	1683.9	1714.8	1800.5	3638.4	6580.9	7659.5
1979-1980	7598.6	7677.0	6903.0	6219.5	5234.3	4533.4	2363.3	1747.8	1412.9	908.0	1210.3	4045.8	6325.8	7772.8
1980-1981	7768.0	7687.1	7293.0	7029.8	6617.8	5162.9	3142.9	1637.4	1408.9	1388.4	1622.9	3720.4	6428.5	7814.6
1981-1982	7814.6	7814.6	7499.5	7120.6	6617.8	5162.9	3041.1	1482.5	1082.3	973.7	1023.2	2732.2	5785.3	7814.6
1982-1983	7779.5	7814.6	7499.5	7120.6	6617.8	5162.9	3088.6	1669.2	1490.1	1537.5	1842.2	3892.4	6360.1	7814.6
1983-1984	7779.5	7814.6	7499.5	7120.6	6617.8	5162.9	3095.7	1756.7	1481.0	1492.5	1696.0	2641.5	5738.1	7622.5
1984-1985	7779.5	7814.6	7499.5	7120.6	6617.8	5162.9	2969.6	1756.7	1683.9	1793.1	2032.0	4045.8	6472.6	7522.4
1985-1986	7460.0	7414.0	6997.1	6947.2	6562.2	5162.9	3003.8	1435.6	1190.9	1239.0	1316.1	3322.7	6242.2	7814.6
1986-1987	7779.5	7742.0	7279.5	7006.4	6617.8	5162.9	3010.1	1756.7	1660.9	1766.7	2029.5	4045.8	5734.4	6770.1
1987-1988	6872.8	6672.3	5880.4	4820.5	3460.8	2316.0	1130.9	191.4	0.0	128.7	833.3	3153.9	5179.0	6077.8

**Exhibit 9 - Composite Canadian Storage Contents – Continued**

From the DOP19 80-Year Continuous TSR Study; Units in ksf

<u>Water Year</u>	<u>AU1</u>	<u>AU2</u>	<u>SEP</u>	<u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>AP1</u>	<u>AP2</u>	<u>MAY</u>	<u>JUN</u>	<u>JUL</u>
1988-1989	5928.2	5739.1	4807.5	4348.9	3470.4	2328.1	1220.7	270.4	169.0	201.1	536.5	2491.9	5518.3	6967.6
1989-1990	7338.7	7612.1	6951.3	6336.6	6443.1	5162.9	3066.3	1512.9	1046.6	975.5	1366.5	3043.2	6123.5	7814.6
1990-1991	7779.5	7814.6	7395.8	6990.8	6617.8	5162.9	3112.1	1656.4	944.7	703.7	1019.8	3238.6	6126.4	7814.6
1991-1992	7814.6	7814.6	7499.5	6671.6	6161.0	5162.9	3029.6	1756.7	1683.9	1795.2	2040.4	4045.8	5633.2	6658.2
1992-1993	6647.5	6351.6	5521.3	4897.6	3698.7	2300.1	1115.2	189.0	168.3	237.6	433.9	3143.7	5272.1	6274.1
1993-1994	6502.2	6742.0	6665.3	6015.0	4657.2	3278.3	1705.5	961.1	982.2	1201.2	1861.9	4045.8	5617.5	7044.3
1994-1995	7193.8	6988.1	6038.2	5064.0	3808.8	2842.9	2326.7	1593.0	1097.8	793.6	854.2	2452.1	5624.8	7378.0
1995-1996	7703.2	7745.8	7235.6	7120.6	6617.8	5162.9	3160.7	1581.7	964.4	808.5	1003.1	2782.7	5800.4	7814.6
1996-1997	7779.5	7814.6	7499.5	7120.6	6617.8	5162.9	3035.8	1475.4	857.7	569.7	470.7	2543.9	5772.6	7814.6
1997-1998	7779.5	7814.6	7499.5	7120.6	6617.8	5162.9	3073.2	1756.7	1543.6	1598.0	1843.0	4045.8	6471.1	7814.6
1998-1999	7779.5	7736.8	7314.2	6808.1	6512.8	5162.9	3062.7	1507.0	987.7	928.0	1244.0	2935.8	5912.7	7814.6
1999-2000	7814.6	7814.6	7499.5	7120.6	6617.8	5162.9	3113.3	1642.2	1358.2	1417.2	1721.6	3529.7	6185.3	7814.6
2000-2001	7779.5	7672.5	7219.1	6899.6	6235.4	4935.6	2986.4	1414.4	974.3	844.2	919.4	2592.0	4097.2	4929.5
2001-2002	4709.2	4430.4	3442.8	2654.3	1449.6	242.7	266.5	0.0	0.0	43.0	183.8	1930.3	5329.6	7532.3
2002-2003	7536.2	7585.6	6775.9	5781.7	4565.6	3193.3	2230.9	1756.7	1683.9	1795.2	2040.4	3022.2	5915.3	7156.0
2003-2004	7260.8	7125.3	6419.7	6531.8	5742.5	4579.1	2989.6	1756.7	1683.9	1795.2	2040.4	3656.6	5926.9	7304.5
2004-2005	7375.8	7664.1	7499.5	7120.6	6617.8	5162.9	3281.3	1879.1	1683.9	1777.5	2040.4	4045.8	6512.5	7814.6
2005-2006	7690.8	7594.8	6775.9	7120.6	6617.8	5162.9	3139.2	1648.3	1318.7	1410.9	1720.9	4007.3	6724.3	7814.6
2006-2007	7592.0	7476.0	6775.9	5781.7	5947.8	5134.7	3006.9	1367.1	49.5	65.2	372.7	2670.7	5743.2	7814.6
2007-2008	7743.1	7526.3	6707.0	6216.4	5410.3	4728.0	2624.8	1756.7	1306.1	910.8	885.0	3258.2	5658.1	7427.1
<b>Max.</b>	7814.6	7814.6	7499.5	7120.6	6617.8	5162.9	3398.8	1879.1	1683.9	1795.2	2040.4	4045.8	6724.3	7814.6
<b>90%</b>	7804.8	7814.6	7499.5	7120.6	6617.8	5162.9	3282.1	1756.7	1670.9	1720.0	1994.9	4045.8	6471.3	7814.6
<b>Average</b>	7431.1	7413.6	6928.0	6476.5	5877.2	4574.9	2713.8	1407.4	1038.8	972.6	1162.8	3033.8	5789.5	7407.9
<b>Median</b>	7779.5	7765.8	7312.9	7016.8	6613.1	5162.9	3034.7	1526.4	1088.9	959.5	1217.7	3032.7	5892.6	7814.6
<b>10%</b>	6478.1	6325.2	5505.5	4889.9	3873.1	2971.4	1220.7	438.2	158.7	139.2	344.4	2181.3	4890.7	6412.3
<b>Min.</b>	4129.8	4017.4	3351.7	2654.3	1449.6	233.0	0.0	0.0	0.0	0.7	0.0	1556.8	4032.6	4303.8



**Exhibit 10 – Duncan Reservoir Storage/Elevation Table**

Units in ksf; Dated 21February 1973; Updated 1 February 2013

Elevation (feet)	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	Average Difference (per 0.1 ft)
1,893	714.8										
1,892	705.8	706.7	707.6	708.5	709.4	710.3	711.2	712.1	713.0	713.9	0.90
1,891	696.9	697.8	698.7	699.6	700.5	701.3	702.2	703.1	704.0	704.9	0.89
1,890	688.0	688.9	689.8	690.7	691.6	692.4	693.3	694.2	695.1	696.0	0.89
1,889	679.2	680.1	681.0	681.8	682.7	683.6	684.5	685.4	686.2	687.1	0.88
1,888	670.4	671.3	672.2	673.0	673.9	674.8	675.7	676.6	677.4	678.3	0.88
1,887	661.5	662.4	663.3	664.2	665.1	665.9	666.8	667.7	668.6	669.5	0.89
1,886	652.8	653.7	654.5	655.4	656.3	657.1	658.0	658.9	659.8	660.6	0.87
1,885	644.0	644.9	645.8	646.6	647.5	648.4	649.3	650.2	651.0	651.9	0.88
1,884	635.3	636.2	637.0	637.9	638.8	639.6	640.5	641.4	642.3	643.1	0.87
1,883	626.6	627.5	628.3	629.2	630.1	630.9	631.8	632.7	633.6	634.4	0.87
1,882	617.9	618.8	619.6	620.5	621.4	622.2	623.1	624.0	624.9	625.7	0.87
1,881	609.2	610.1	610.9	611.8	612.7	613.5	614.4	615.3	616.2	617.0	0.87
1,880	600.6	601.5	602.3	603.2	604.0	604.9	605.8	606.6	607.5	608.3	0.86
1,879	592.0	592.9	593.7	594.6	595.4	596.3	597.2	598.0	598.9	599.7	0.86
1,878	583.4	584.3	585.1	586.0	586.8	587.7	588.6	589.4	590.3	591.1	0.86
1,877	574.8	575.7	576.5	577.4	578.2	579.1	580.0	580.8	581.7	582.5	0.86
1,876	566.3	567.1	568.0	568.8	569.7	570.5	571.4	572.2	573.1	573.9	0.85
1,875	557.8	558.6	559.5	560.3	561.2	562.0	562.9	563.7	564.6	565.4	0.85
1,874	549.3	550.1	551.0	551.8	552.7	553.5	554.4	555.2	556.1	556.9	0.85
1,873	540.9	541.7	542.6	543.4	544.3	545.1	545.9	546.8	547.6	548.5	0.84
1,872	532.4	533.2	534.1	534.9	535.8	536.6	537.5	538.3	539.2	540.0	0.85
1,871	524.0	524.8	525.7	526.5	527.4	528.2	529.0	529.9	530.7	531.6	0.84
1,870	515.7	516.5	517.4	518.2	519.0	519.8	520.7	521.5	522.3	523.2	0.83
1,869	507.3	508.1	509.0	509.8	510.7	511.5	512.3	513.2	514.0	514.9	0.84
1,868	499.0	499.8	500.7	501.5	502.3	503.1	504.0	504.8	505.6	506.5	0.83
1,867	490.7	491.5	492.4	493.2	494.0	494.8	495.7	496.5	497.3	498.2	0.83
1,866	482.4	483.2	484.1	484.9	485.7	486.5	487.4	488.2	489.0	489.9	0.83
1,865	474.2	475.0	475.8	476.7	477.5	478.3	479.1	479.9	480.8	481.6	0.82
1,864	466.0	466.8	467.6	468.5	469.3	470.1	470.9	471.7	472.6	473.4	0.82
1,863	457.8	458.6	459.4	460.3	461.1	461.9	462.7	463.5	464.4	465.2	0.82
1,862	449.7	450.5	451.3	452.1	452.9	453.7	454.6	455.4	456.2	457.0	0.81
1,861	441.6	442.4	443.2	444.0	444.8	445.6	446.5	447.3	448.1	448.9	0.81
1,860	433.5	434.3	435.1	435.9	436.7	437.5	438.4	439.2	440.0	440.8	0.81
1,859	425.4	426.2	427.0	427.8	428.6	429.4	430.3	431.1	431.9	432.7	0.81
1,858	417.4	418.2	419.0	419.8	420.6	421.4	422.2	423.0	423.8	424.6	0.80
1,857	409.4	410.2	411.0	411.8	412.6	413.4	414.2	415.0	415.8	416.6	0.80
1,856	401.4	402.2	403.0	403.8	404.6	405.4	406.2	407.0	407.8	408.6	0.80
1,855	393.5	394.3	395.1	395.9	396.7	397.4	398.2	399.0	399.8	400.6	0.79
1,854	385.6	386.4	387.2	388.0	388.8	389.5	390.3	391.1	391.9	392.7	0.79
1,853	377.7	378.5	379.3	380.1	380.9	381.6	382.4	383.2	384.0	384.8	0.79
1,852	369.9	370.7	371.5	372.2	373.0	373.8	374.6	375.4	376.1	376.9	0.78
1,851	362.1	362.9	363.7	364.4	365.2	366.0	366.8	367.6	368.3	369.1	0.78
1,850	354.3	355.1	355.9	356.6	357.4	358.2	359.0	359.8	360.5	361.3	0.78

## Exhibit 10 – Duncan Reservoir Storage/Elevation Table – Continued

Elevation (feet)	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	Average Difference (per 0.1 ft)
1,849	346.6	347.4	348.1	348.9	349.7	350.4	351.2	352.0	352.8	353.5	0.77
1,848	338.9	339.7	340.4	341.2	342.0	342.7	343.5	344.3	345.1	345.8	0.77
1,847	331.2	332.0	332.7	333.5	334.3	335.0	335.8	336.6	337.4	338.1	0.77
1,846	323.6	324.4	325.1	325.9	326.6	327.4	328.2	328.9	329.7	330.4	0.76
1,845	316.0	316.8	317.5	318.3	319.0	319.8	320.6	321.3	322.1	322.8	0.76
1,844	308.5	309.2	310.0	310.7	311.5	312.2	313.0	313.7	314.5	315.2	0.75
1,843	300.9	301.7	302.4	303.2	303.9	304.7	305.5	306.2	307.0	307.7	0.76
1,842	293.5	294.2	295.0	295.7	296.5	297.2	297.9	298.7	299.4	300.2	0.74
1,841	286.0	286.7	287.5	288.2	289.0	289.7	290.5	291.2	292.0	292.7	0.75
1,840	278.6	279.3	280.1	280.8	281.6	282.3	283.0	283.8	284.5	285.3	0.74
1,839	271.2	271.9	272.7	273.4	274.2	274.9	275.6	276.4	277.1	277.9	0.74
1,838	263.9	264.6	265.4	266.1	266.8	267.5	268.3	269.0	269.7	270.5	0.73
1,837	256.6	257.3	258.1	258.8	259.5	260.2	261.0	261.7	262.4	263.2	0.73
1,836	249.4	250.1	250.8	251.6	252.3	253.0	253.7	254.4	255.2	255.9	0.72
1,835	242.2	242.9	243.6	244.4	245.1	245.8	246.5	247.2	248.0	248.7	0.72
1,834	235.0	235.7	236.4	237.2	237.9	238.6	239.3	240.0	240.8	241.5	0.72
1,833	227.9	228.6	229.3	230.0	230.7	231.4	232.2	232.9	233.6	234.3	0.71
1,832	220.8	221.5	222.2	222.9	223.6	224.3	225.1	225.8	226.5	227.2	0.71
1,831	213.8	214.5	215.2	215.9	216.6	217.3	218.0	218.7	219.4	220.1	0.70
1,830	206.8	207.5	208.2	208.9	209.6	210.3	211.0	211.7	212.4	213.1	0.70
1,829	199.9	200.6	201.3	202.0	202.7	203.3	204.0	204.7	205.4	206.1	0.69
1,828	193.0	193.7	194.4	195.1	195.8	196.4	197.1	197.8	198.5	199.2	0.69
1,827	186.1	186.8	187.5	188.2	188.9	189.5	190.2	190.9	191.6	192.3	0.69
1,826	179.3	180.0	180.7	181.3	182.0	182.7	183.4	184.1	184.7	185.4	0.68
1,825	172.6	173.3	173.9	174.6	175.3	175.9	176.6	177.3	178.0	178.6	0.67
1,824	165.9	166.6	167.2	167.9	168.6	169.2	169.9	170.6	171.3	171.9	0.67
1,823	159.2	159.9	160.5	161.2	161.9	162.5	163.2	163.9	164.6	165.2	0.67
1,822	152.6	153.3	153.9	154.6	155.2	155.9	156.6	157.2	157.9	158.5	0.66
1,821	146.1	146.7	147.4	148.0	148.7	149.3	150.0	150.6	151.3	151.9	0.65
1,820	139.6	140.2	140.9	141.5	142.2	142.8	143.5	144.1	144.8	145.4	0.65
1,819	133.2	133.8	134.5	135.1	135.8	136.4	137.0	137.7	138.3	139.0	0.64
1,818	126.8	127.4	128.1	128.7	129.4	130.0	130.6	131.3	131.9	132.6	0.64
1,817	120.5	121.1	121.8	122.4	123.0	123.6	124.3	124.9	125.5	126.2	0.63
1,816	114.3	114.9	115.5	116.2	116.8	117.4	118.0	118.6	119.3	119.9	0.62
1,815	108.1	108.7	109.3	110.0	110.6	111.2	111.8	112.4	113.1	113.7	0.62
1,814	102.0	102.6	103.2	103.8	104.4	105.0	105.7	106.3	106.9	107.5	0.61
1,813	96.0	96.6	97.2	97.8	98.4	99.0	99.6	100.2	100.8	101.4	0.60
1,812	90.0	90.6	91.2	91.8	92.4	93.0	93.6	94.2	94.8	95.4	0.60
1,811	84.1	84.7	85.3	85.9	86.5	87.0	87.6	88.2	88.8	89.4	0.59
1,810	78.3	78.9	79.5	80.0	80.6	81.2	81.8	82.4	82.9	83.5	0.58
1,809	72.5	73.1	73.7	74.2	74.8	75.4	76.0	76.6	77.1	77.7	0.58
1,808	66.9	67.5	68.0	68.6	69.1	69.7	70.3	70.8	71.4	71.9	0.56
1,807	61.3	61.9	62.4	63.0	63.5	64.1	64.7	65.2	65.8	66.3	0.56
1,806	55.8	56.3	56.9	57.4	58.0	58.5	59.1	59.6	60.2	60.7	0.55
1,805	50.4	50.9	51.5	52.0	52.6	53.1	53.6	54.2	54.7	55.3	0.54

**Exhibit 10 – Duncan Reservoir Storage/Elevation Table – Continued**

Elevation (feet)	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	Average Difference (per 0.1 ft)
1,804	45.1	45.6	46.2	46.7	47.2	47.7	48.3	48.8	49.3	49.9	0.53
1,803	39.9	40.4	40.9	41.5	42.0	42.5	43.0	43.5	44.1	44.6	0.52
1,802	34.8	35.3	35.8	36.3	36.8	37.3	37.9	38.4	38.9	39.4	0.51
1,801	29.8	30.3	30.8	31.3	31.8	32.3	32.8	33.3	33.8	34.3	0.50
1,800	25.0	25.5	26.0	26.4	26.9	27.4	27.9	28.4	28.8	29.3	0.48
1,799	20.3	20.8	21.2	21.7	22.2	22.6	23.1	23.6	24.1	24.5	0.47
1,798	15.7	16.2	16.6	17.1	17.5	18.0	18.5	18.9	19.4	19.8	0.46
1,797	11.3	11.7	12.2	12.6	13.1	13.5	13.9	14.4	14.8	15.3	0.44
1,796	7.1	7.5	7.9	8.4	8.8	9.2	9.6	10.0	10.5	10.9	0.42
1,795	3.0	3.4	3.8	4.2	4.6	5.0	5.5	5.9	6.3	6.7	0.41
1,794	-0.7	-0.3	0.0	0.4	0.8	1.2	1.5	1.9	2.3	2.6	0.37
1,793	-4.2	-3.9	-3.5	-3.2	-2.8	-2.5	-2.1	-1.8	-1.4	-1.1	0.35
1,792	-7.3	-7.0	-6.7	-6.4	-6.1	-5.8	-5.5	-5.2	-4.9	-4.5	0.31
1,791				-9.1	-8.8	-8.6	-8.3	-8.0	-7.8	-7.5	0.26

**Exhibit 11 – Arrow Reservoir Storage/Elevation Table**

Units in ksf; Dated 28 February 1974; Updated 1 February 2013

Elevation (feet)	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	Average Difference (per 0.1 ft)
1,446	3,710.6										
1,445	3,645.1	3,651.7	3,658.2	3,664.8	3,671.3	3,677.9	3,684.4	3,691.0	3,697.5	3,704.1	6.55
1,444	3,579.6	3,586.2	3,592.7	3,599.3	3,605.8	3,612.4	3,618.9	3,625.5	3,632.0	3,638.6	6.55
1,443	3,514.1	3,520.6	3,527.2	3,533.7	3,540.3	3,546.8	3,553.4	3,559.9	3,566.5	3,573.0	6.55
1,442	3,448.9	3,455.4	3,461.9	3,468.5	3,475.0	3,481.5	3,488.0	3,494.5	3,501.1	3,507.6	6.52
1,441	3,384.0	3,390.5	3,397.0	3,403.5	3,410.0	3,416.4	3,422.9	3,429.4	3,435.9	3,442.4	6.49
1,440	3,319.5	3,325.9	3,332.4	3,338.8	3,345.3	3,351.7	3,358.2	3,364.6	3,371.1	3,377.5	6.45
1,439	3,255.2	3,261.6	3,268.1	3,274.5	3,280.9	3,287.3	3,293.8	3,300.2	3,306.6	3,313.1	6.43
1,438	3,191.4	3,197.8	3,204.2	3,210.5	3,216.9	3,223.3	3,229.7	3,236.1	3,242.4	3,248.8	6.38
1,437	3,127.8	3,134.2	3,140.5	3,146.9	3,153.2	3,159.6	3,166.0	3,172.3	3,178.7	3,185.0	6.36
1,436	3,064.6	3,070.9	3,077.2	3,083.6	3,089.9	3,096.2	3,102.5	3,108.8	3,115.2	3,121.5	6.32
1,435	3,001.7	3,008.0	3,014.3	3,020.6	3,026.9	3,033.1	3,039.4	3,045.7	3,052.0	3,058.3	6.29
1,434	2,939.2	2,945.4	2,951.7	2,957.9	2,964.2	2,970.4	2,976.7	2,982.9	2,989.2	2,995.4	6.25
1,433	2,877.0	2,883.2	2,889.4	2,895.7	2,901.9	2,908.1	2,914.3	2,920.5	2,926.8	2,933.0	6.22
1,432	2,815.1	2,821.3	2,827.5	2,833.7	2,839.9	2,846.0	2,852.2	2,858.4	2,864.6	2,870.8	6.19
1,431	2,753.5	2,759.7	2,765.8	2,772.0	2,778.1	2,784.3	2,790.5	2,796.6	2,802.8	2,808.9	6.16
1,430	2,692.3	2,698.4	2,704.5	2,710.7	2,716.8	2,722.9	2,729.0	2,735.1	2,741.3	2,747.4	6.12
1,429	2,631.5	2,637.6	2,643.7	2,649.7	2,655.8	2,661.9	2,668.0	2,674.1	2,680.1	2,686.2	6.08
1,428	2,570.9	2,577.0	2,583.0	2,589.1	2,595.1	2,601.2	2,607.3	2,613.3	2,619.4	2,625.4	6.06
1,427	2,510.7	2,516.7	2,522.7	2,528.8	2,534.8	2,540.8	2,546.8	2,552.8	2,558.9	2,564.9	6.02
1,426	2,450.8	2,456.8	2,462.8	2,468.8	2,474.8	2,480.7	2,486.7	2,492.7	2,498.7	2,504.7	5.99
1,425	2,391.2	2,397.2	2,403.1	2,409.1	2,415.0	2,421.0	2,427.0	2,432.9	2,438.9	2,444.8	5.96
1,424	2,331.9	2,337.8	2,343.8	2,349.7	2,355.6	2,361.5	2,367.5	2,373.4	2,379.3	2,385.3	5.93
1,423	2,272.8	2,278.7	2,284.6	2,290.5	2,296.4	2,302.3	2,308.3	2,314.2	2,320.1	2,326.0	5.91
1,422	2,214.1	2,220.0	2,225.8	2,231.7	2,237.6	2,243.4	2,249.3	2,255.2	2,261.1	2,266.9	5.87
1,421	2,155.7	2,161.5	2,167.4	2,173.2	2,179.1	2,184.9	2,190.7	2,196.6	2,202.4	2,208.3	5.84
1,420	2,097.7	2,103.5	2,109.3	2,115.1	2,120.9	2,126.7	2,132.5	2,138.3	2,144.1	2,149.9	5.8
1,419	2,040.1	2,045.9	2,051.6	2,057.4	2,063.1	2,068.9	2,074.7	2,080.4	2,086.2	2,091.9	5.76
1,418	1,982.9	1,988.6	1,994.3	2,000.1	2,005.8	2,011.5	2,017.2	2,022.9	2,028.7	2,034.4	5.72
1,417	1,926.1	1,931.8	1,937.5	1,943.1	1,948.8	1,954.5	1,960.2	1,965.9	1,971.5	1,977.2	5.68
1,416	1,869.6	1,875.2	1,880.9	1,886.5	1,892.2	1,897.8	1,903.5	1,909.1	1,914.8	1,920.4	5.65
1,415	1,813.5	1,819.1	1,824.7	1,830.3	1,835.9	1,841.5	1,847.2	1,852.8	1,858.4	1,864.0	5.61
1,414	1,757.8	1,763.4	1,768.9	1,774.5	1,780.1	1,785.6	1,791.2	1,796.8	1,802.4	1,807.9	5.57
1,413	1,702.4	1,707.9	1,713.5	1,719.0	1,724.6	1,730.1	1,735.6	1,741.2	1,746.7	1,752.3	5.54
1,412	1,647.4	1,652.9	1,658.4	1,663.9	1,669.4	1,674.9	1,680.4	1,685.9	1,691.4	1,696.9	5.5
1,411	1,592.7	1,598.2	1,603.6	1,609.1	1,614.6	1,620.0	1,625.5	1,631.0	1,636.5	1,641.9	5.47
1,410	1,538.4	1,543.8	1,549.3	1,554.7	1,560.1	1,565.5	1,571.0	1,576.4	1,581.8	1,587.3	5.43
1,409	1,484.5	1,489.9	1,495.3	1,500.7	1,506.1	1,511.4	1,516.8	1,522.2	1,527.6	1,533.0	5.39
1,408	1,430.9	1,436.3	1,441.6	1,447.0	1,452.3	1,457.7	1,463.1	1,468.4	1,473.8	1,479.1	5.36
1,407	1,377.7	1,383.0	1,388.3	1,393.7	1,399.0	1,404.3	1,409.6	1,414.9	1,420.3	1,425.6	5.32
1,406	1,324.7	1,330.0	1,335.3	1,340.6	1,345.9	1,351.2	1,356.5	1,361.8	1,367.1	1,372.4	5.3
1,405	1,272.1	1,277.4	1,282.6	1,287.9	1,293.1	1,298.4	1,303.7	1,308.9	1,314.2	1,319.4	5.26

**Exhibit 11 – Arrow Reservoir Storage/Elevation Table – Continued**

Elevation (feet)	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	Average Difference (per 0.1 ft)
1,404	1,219.5	1,224.8	1,230.0	1,235.3	1,240.5	1,245.8	1,251.1	1,256.3	1,261.6	1,266.8	5.26
1,403	1,167.3	1,172.5	1,177.7	1,183.0	1,188.2	1,193.4	1,198.6	1,203.8	1,209.1	1,214.3	5.22
1,402	1,115.4	1,120.6	1,125.8	1,131.0	1,136.2	1,141.3	1,146.5	1,151.7	1,156.9	1,162.1	5.19
1,401	1,063.9	1,069.0	1,074.2	1,079.3	1,084.5	1,089.6	1,094.8	1,099.9	1,105.1	1,110.2	5.15
1,400	1,012.8	1,017.9	1,023.0	1,028.1	1,033.2	1,038.3	1,043.5	1,048.6	1,053.7	1,058.8	5.11
1,399	962.5	967.5	972.6	977.6	982.6	987.6	992.7	997.7	1,002.7	1,007.8	5.03
1,398	912.7	917.7	922.7	927.6	932.6	937.6	942.6	947.6	952.5	957.5	4.98
1,397	863.2	868.1	873.1	878.0	883.0	887.9	892.9	897.8	902.8	907.7	4.95
1,396	814.1	819.0	823.9	828.8	833.7	838.6	843.6	848.5	853.4	858.3	4.91
1,395	765.2	770.1	775.0	779.9	784.8	789.6	794.5	799.4	804.3	809.2	4.89
1,394	716.2	721.1	726.0	730.9	735.8	740.7	745.6	750.5	755.4	760.3	4.9
1,393	667.5	672.4	677.2	682.1	687.0	691.8	696.7	701.6	706.5	711.3	4.87
1,392	619.3	624.1	628.9	633.8	638.6	643.4	648.2	653.0	657.9	662.7	4.82
1,391	571.5	576.3	581.1	585.8	590.6	595.4	600.2	605.0	609.7	614.5	4.78
1,390	524.2	528.9	533.7	538.4	543.1	547.8	552.6	557.3	562.0	566.8	4.73
1,389	477.9	482.5	487.2	491.8	496.4	501.0	505.7	510.3	514.9	519.6	4.63
1,388	432.3	436.9	441.4	446.0	450.5	455.1	459.7	464.2	468.8	473.3	4.56
1,387	387.2	391.7	396.2	400.7	405.2	409.7	414.3	418.8	423.3	427.8	4.51
1,386	342.6	347.1	351.5	356.0	360.4	364.9	369.4	373.8	378.3	382.7	4.46
1,385	298.5	302.9	307.3	311.7	316.1	320.5	325.0	329.4	333.8	338.2	4.41
1,384	254.6	259.0	263.4	267.8	272.2	276.5	280.9	285.3	289.7	294.1	4.39
1,383	211.2	215.5	219.9	224.2	228.6	232.9	237.2	241.6	245.9	250.3	4.34
1,382	168.4	172.7	177.0	181.2	185.5	189.8	194.1	198.4	202.6	206.9	4.28
1,381	126.1	130.3	134.6	138.8	143.0	147.2	151.5	155.7	159.9	164.2	4.23
1,380	84.3	88.5	92.7	96.8	101.0	105.2	109.4	113.6	117.7	121.9	4.18
1,379	43.2	47.3	51.4	55.5	59.6	63.7	67.9	72.0	76.1	80.2	4.11
1,378	2.7	6.7	10.8	14.8	18.9	22.9	27.0	31.0	35.1	39.1	4.05
1,377	-42.4	-37.7	-33.0	-28.3	-23.6	-18.8	-14.1	-9.4	-4.7	0.0	4.71
1,376	-89.5	-84.8	-80.1	-75.4	-70.7	-65.9	-61.2	-56.5	-51.8	-47.1	4.71
1,375	-134.7	-130.2	-125.7	-121.2	-116.6	-112.1	-107.6	-103.1	-98.5	-94.0	4.53
1,374	-179.7	-175.2	-170.7	-166.2	-161.7	-157.2	-152.7	-148.2	-143.7	-139.2	4.50
1,373	-224.5	-220.0	-215.5	-211.1	-206.6	-202.1	-197.6	-193.2	-188.7	-184.2	4.47
1,372	-268.9	-264.5	-260.0	-255.6	-251.2	-246.7	-242.3	-237.8	-233.4	-228.9	4.45
1,371	-313.2	-308.7	-304.3	-299.9	-295.5	-291.0	-286.6	-282.2	-277.8	-273.4	4.42
1,370					-339.3	-334.9	-330.6	-326.2	-321.9	-317.5	4.35

**Exhibit 12 – Mica Reservoir Storage/Elevation Table**

Units in ksf; Dated 25 March 1974; Updated 1 February 2013

Elevation (feet)	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	Average Difference (per 0.1 ft)
2,478	10,282.9										
2,477	10,228.8	10,234.2	10,239.7	10,245.1	10,250.5	10,255.9	10,261.3	10,266.7	10,272.1	10,277.5	5.41
2,476	10,174.9	10,180.3	10,185.7	10,191.1	10,196.5	10,201.9	10,207.3	10,212.7	10,218.0	10,223.4	5.39
2,475	10,121.1	10,126.5	10,131.9	10,137.2	10,142.6	10,148.0	10,153.4	10,158.8	10,164.1	10,169.5	5.38
2,474	10,067.5	10,072.9	10,078.2	10,083.6	10,088.9	10,094.3	10,099.7	10,105.0	10,110.4	10,115.7	5.36
2,473	10,014.1	10,019.4	10,024.8	10,030.1	10,035.5	10,040.8	10,046.1	10,051.5	10,056.8	10,062.2	5.34
2,472	9,960.8	9,966.1	9,971.5	9,976.8	9,982.1	9,987.4	9,992.8	9,998.1	10,003.4	10,008.8	5.33
2,471	9,907.8	9,913.1	9,918.4	9,923.7	9,929.0	9,934.3	9,939.6	9,944.9	9,950.2	9,955.5	5.30
2,470	9,854.8	9,860.1	9,865.4	9,870.7	9,876.0	9,881.3	9,886.6	9,891.9	9,897.2	9,902.5	5.30
2,469	9,802.1	9,807.4	9,812.6	9,817.9	9,823.2	9,828.5	9,833.7	9,839.0	9,844.3	9,849.5	5.27
2,468	9,749.5	9,754.8	9,760.0	9,765.3	9,770.5	9,775.8	9,781.1	9,786.3	9,791.6	9,796.8	5.26
2,467	9,697.1	9,702.3	9,707.6	9,712.8	9,718.1	9,723.3	9,728.5	9,733.8	9,739.0	9,744.3	5.24
2,466	9,644.8	9,650.0	9,655.3	9,660.5	9,665.7	9,671.0	9,676.2	9,681.4	9,686.6	9,691.9	5.23
2,465	9,592.7	9,597.9	9,603.1	9,608.3	9,613.5	9,618.8	9,624.0	9,629.2	9,634.4	9,639.6	5.21
2,464	9,540.8	9,546.0	9,551.2	9,556.4	9,561.6	9,566.8	9,571.9	9,577.1	9,582.3	9,587.5	5.19
2,463	9,489.0	9,494.2	9,499.4	9,504.5	9,509.7	9,514.9	9,520.1	9,525.3	9,530.4	9,535.6	5.18
2,462	9,437.4	9,442.6	9,447.7	9,452.9	9,458.0	9,463.2	9,468.4	9,473.5	9,478.7	9,483.8	5.16
2,461	9,386.0	9,391.1	9,396.3	9,401.4	9,406.6	9,411.7	9,416.8	9,422.0	9,427.1	9,432.3	5.14
2,460	9,334.8	9,339.9	9,345.0	9,350.2	9,355.3	9,360.4	9,365.5	9,370.6	9,375.8	9,380.9	5.12
2,459	9,283.7	9,288.8	9,293.9	9,299.0	9,304.1	9,309.3	9,314.4	9,319.5	9,324.6	9,329.7	5.11
2,458	9,232.8	9,237.9	9,243.0	9,248.1	9,253.2	9,258.3	9,263.3	9,268.4	9,273.5	9,278.6	5.09
2,457	9,182.0	9,187.1	9,192.2	9,197.2	9,202.3	9,207.4	9,212.5	9,217.6	9,222.6	9,227.7	5.08
2,456	9,131.4	9,136.5	9,141.5	9,146.6	9,151.6	9,156.7	9,161.8	9,166.8	9,171.9	9,176.9	5.06
2,455	9,081.0	9,086.0	9,091.1	9,096.1	9,101.2	9,106.2	9,111.2	9,116.3	9,121.3	9,126.4	5.04
2,454	9,030.8	9,035.8	9,040.8	9,045.9	9,050.9	9,055.9	9,060.9	9,065.9	9,071.0	9,076.0	5.02
2,453	8,980.7	8,985.7	8,990.7	8,995.7	9,000.7	9,005.8	9,010.8	9,015.8	9,020.8	9,025.8	5.01
2,452	8,930.8	8,935.8	8,940.8	8,945.8	8,950.8	8,955.8	8,960.7	8,965.7	8,970.7	8,975.7	4.99
2,451	8,881.0	8,886.0	8,891.0	8,895.9	8,900.9	8,905.9	8,910.9	8,915.9	8,920.8	8,925.8	4.98
2,450	8,831.4	8,836.4	8,841.3	8,846.3	8,851.2	8,856.2	8,861.2	8,866.1	8,871.1	8,876.0	4.96
2,449	8,782.0	8,786.9	8,791.9	8,796.8	8,801.8	8,806.7	8,811.6	8,816.6	8,821.5	8,826.5	4.94
2,448	8,732.8	8,737.7	8,742.6	8,747.6	8,752.5	8,757.4	8,762.3	8,767.2	8,772.2	8,777.1	4.92
2,447	8,683.7	8,688.6	8,693.5	8,698.4	8,703.3	8,708.3	8,713.2	8,718.1	8,723.0	8,727.9	4.91
2,446	8,634.8	8,639.7	8,644.6	8,649.5	8,654.4	8,659.3	8,664.1	8,669.0	8,673.9	8,678.8	4.89
2,445	8,586.0	8,590.9	8,595.8	8,600.6	8,605.5	8,610.4	8,615.3	8,620.2	8,625.0	8,629.9	4.88
2,444	8,537.5	8,542.4	8,547.2	8,552.1	8,556.9	8,561.8	8,566.6	8,571.5	8,576.3	8,581.2	4.85
2,443	8,489.1	8,493.9	8,498.8	8,503.6	8,508.5	8,513.3	8,518.1	8,523.0	8,527.8	8,532.7	4.84
2,442	8,440.8	8,445.6	8,450.5	8,455.3	8,460.1	8,465.0	8,469.8	8,474.6	8,479.4	8,484.3	4.83
2,441	8,392.7	8,397.5	8,402.3	8,407.1	8,411.9	8,416.8	8,421.6	8,426.4	8,431.2	8,436.0	4.81
2,440	8,344.8	8,349.6	8,354.4	8,359.2	8,364.0	8,368.8	8,373.5	8,378.3	8,383.1	8,387.9	4.79
2,439	8,297.1	8,301.9	8,306.6	8,311.4	8,316.2	8,321.0	8,325.7	8,330.5	8,335.3	8,340.0	4.77
2,438	8,249.5	8,254.3	8,259.0	8,263.8	8,268.5	8,273.3	8,278.1	8,282.8	8,287.6	8,292.3	4.76
2,437	8,202.1	8,206.8	8,211.6	8,216.3	8,221.1	8,225.8	8,230.5	8,235.3	8,240.0	8,244.8	4.74
2,436	8,154.8	8,159.5	8,164.3	8,169.0	8,173.7	8,178.5	8,183.2	8,187.9	8,192.6	8,197.4	4.73
2,435	8,107.8	8,112.5	8,117.2	8,121.9	8,126.6	8,131.3	8,136.0	8,140.7	8,145.4	8,150.1	4.70

**Exhibit 12 – Mica Reservoir Storage/Elevation Table – Continued**

Elevation (feet)	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	Average Difference (per 0.1 ft)
2,434	8,060.9	8,065.6	8,070.3	8,075.0	8,079.7	8,084.4	8,089.0	8,093.7	8,098.4	8,103.1	4.69
2,433	8,014.1	8,018.8	8,023.5	8,028.1	8,032.8	8,037.5	8,042.2	8,046.9	8,051.5	8,056.2	4.68
2,432	7,967.5	7,972.2	7,976.8	7,981.5	7,986.1	7,990.8	7,995.5	8,000.1	8,004.8	8,009.4	4.66
2,431	7,921.1	7,925.7	7,930.4	7,935.0	7,939.7	7,944.3	7,948.9	7,953.6	7,958.2	7,962.9	4.64
2,430	7,874.9	7,879.5	7,884.1	7,888.8	7,893.4	7,898.0	7,902.6	7,907.2	7,911.9	7,916.5	4.62
2,429	7,828.8	7,833.4	7,838.0	7,842.6	7,847.2	7,851.9	7,856.5	7,861.1	7,865.7	7,870.3	4.61
2,428	7,782.9	7,787.5	7,792.1	7,796.7	7,801.3	7,805.9	7,810.4	7,815.0	7,819.6	7,824.2	4.59
2,427	7,737.2	7,741.8	7,746.3	7,750.9	7,755.5	7,760.1	7,764.6	7,769.2	7,773.8	7,778.3	4.57
2,426	7,691.6	7,696.2	7,700.7	7,705.3	7,709.8	7,714.4	7,719.0	7,723.5	7,728.1	7,732.6	4.56
2,425	7,646.2	7,650.7	7,655.3	7,659.8	7,664.4	7,668.9	7,673.4	7,678.0	7,682.5	7,687.1	4.54
2,424	7,600.9	7,605.4	7,610.0	7,614.5	7,619.0	7,623.6	7,628.1	7,632.6	7,637.1	7,641.7	4.53
2,423	7,555.9	7,560.4	7,564.9	7,569.4	7,573.9	7,578.4	7,582.9	7,587.4	7,591.9	7,596.4	4.50
2,422	7,511.0	7,515.5	7,520.0	7,524.5	7,529.0	7,533.5	7,537.9	7,542.4	7,546.9	7,551.4	4.49
2,421	7,466.2	7,470.7	7,475.2	7,479.6	7,484.1	7,488.6	7,493.1	7,497.6	7,502.0	7,506.5	4.48
2,420	7,421.6	7,426.1	7,430.5	7,435.0	7,439.4	7,443.9	7,448.4	7,452.8	7,457.3	7,461.7	4.46
2,419	7,377.2	7,381.6	7,386.1	7,390.5	7,395.0	7,399.4	7,403.8	7,408.3	7,412.7	7,417.2	4.44
2,418	7,333.0	7,337.4	7,341.8	7,346.3	7,350.7	7,355.1	7,359.5	7,363.9	7,368.4	7,372.8	4.42
2,417	7,288.9	7,293.3	7,297.7	7,302.1	7,306.5	7,311.0	7,315.4	7,319.8	7,324.2	7,328.6	4.41
2,416	7,245.0	7,249.4	7,253.8	7,258.2	7,262.6	7,267.0	7,271.3	7,275.7	7,280.1	7,284.5	4.39
2,415	7,201.3	7,205.7	7,210.0	7,214.4	7,218.8	7,223.2	7,227.5	7,231.9	7,236.3	7,240.6	4.37
2,414	7,157.7	7,162.1	7,166.4	7,170.8	7,175.1	7,179.5	7,183.9	7,188.2	7,192.6	7,196.9	4.36
2,413	7,114.3	7,118.6	7,123.0	7,127.3	7,131.7	7,136.0	7,140.3	7,144.7	7,149.0	7,153.4	4.34
2,412	7,071.0	7,075.3	7,079.7	7,084.0	7,088.3	7,092.7	7,097.0	7,101.3	7,105.6	7,110.0	4.33
2,411	7,028.0	7,032.3	7,036.6	7,040.9	7,045.2	7,049.5	7,053.8	7,058.1	7,062.4	7,066.7	4.30
2,410	6,985.1	6,989.4	6,993.7	6,998.0	7,002.3	7,006.6	7,010.8	7,015.1	7,019.4	7,023.7	4.29
2,409	6,942.3	6,946.6	6,950.9	6,955.1	6,959.4	6,963.7	6,968.0	6,972.3	6,976.5	6,980.8	4.28
2,408	6,899.7	6,904.0	6,908.2	6,912.5	6,916.7	6,921.0	6,925.3	6,929.5	6,933.8	6,938.0	4.26
2,407	6,857.3	6,861.5	6,865.8	6,870.0	6,874.3	6,878.5	6,882.7	6,887.0	6,891.2	6,895.5	4.24
2,406	6,815.1	6,819.3	6,823.5	6,827.8	6,832.0	6,836.2	6,840.4	6,844.6	6,848.9	6,853.1	4.22
2,405	6,773.0	6,777.2	6,781.4	6,785.6	6,789.8	6,794.1	6,798.3	6,802.5	6,806.7	6,810.9	4.21
2,404	6,731.2	6,735.3	6,739.5	6,743.7	6,747.9	6,752.1	6,756.3	6,760.5	6,764.7	6,768.9	4.20
2,403	6,689.5	6,693.7	6,697.9	6,702.0	6,706.2	6,710.4	6,714.5	6,718.7	6,722.9	6,727.1	4.17
2,402	6,648.0	6,652.2	6,656.3	6,660.5	6,664.7	6,668.8	6,673.0	6,677.1	6,681.3	6,685.5	4.16
2,401	6,606.7	6,610.9	6,615.0	6,619.2	6,623.3	6,627.4	6,631.6	6,635.7	6,639.9	6,644.0	4.14
2,400	6,565.5	6,569.7	6,573.8	6,577.9	6,582.1	6,586.2	6,590.3	6,594.5	6,598.6	6,602.7	4.13
2,399	6,524.6	6,528.7	6,532.8	6,536.9	6,541.0	6,545.1	6,549.2	6,553.3	6,557.4	6,561.5	4.11
2,398	6,483.9	6,487.9	6,492.0	6,496.1	6,500.1	6,504.2	6,508.3	6,512.4	6,516.4	6,520.5	4.07
2,397	6,443.5	6,447.6	6,451.6	6,455.6	6,459.6	6,463.7	6,467.7	6,471.8	6,475.8	6,479.8	4.03
2,396	6,403.5	6,407.5	6,411.5	6,415.5	6,419.5	6,423.5	6,427.5	6,431.5	6,435.5	6,439.5	4.00
2,395	6,363.9	6,367.8	6,371.8	6,375.7	6,379.7	6,383.7	6,387.6	6,391.6	6,395.6	6,399.5	3.96
2,394	6,324.5	6,328.5	6,332.4	6,336.3	6,340.2	6,344.2	6,348.1	6,352.0	6,356.0	6,359.9	3.93
2,393	6,285.6	6,289.5	6,293.4	6,297.2	6,301.1	6,305.0	6,308.9	6,312.8	6,316.7	6,320.6	3.90
2,392	6,246.9	6,250.8	6,254.6	6,258.5	6,262.4	6,266.2	6,270.1	6,274.0	6,277.8	6,281.7	3.87
2,391	6,208.6	6,212.4	6,216.2	6,220.0	6,223.9	6,227.7	6,231.5	6,235.4	6,239.2	6,243.1	3.83
2,390	6,170.6	6,174.4	6,178.2	6,181.9	6,185.7	6,189.5	6,193.3	6,197.2	6,201.0	6,204.8	3.80

**Exhibit 12 – Mica Reservoir Storage/Elevation Table – Continued**

Elevation (feet)	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	Average Difference (per 0.1 ft)
2,389	6,132.9	6,136.7	6,140.4	6,144.2	6,147.9	6,151.7	6,155.5	6,159.2	6,163.0	6,166.8	3.77
2,388	6,095.5	6,099.2	6,103.0	6,106.7	6,110.4	6,114.2	6,117.9	6,121.7	6,125.4	6,129.2	3.74
2,387	6,058.4	6,062.1	6,065.8	6,069.5	6,073.2	6,076.9	6,080.6	6,084.3	6,088.1	6,091.8	3.71
2,386	6,021.7	6,025.3	6,029.0	6,032.7	6,036.3	6,040.0	6,043.7	6,047.4	6,051.0	6,054.7	3.68
2,385	5,985.2	5,988.8	5,992.5	5,996.1	5,999.7	6,003.4	6,007.0	6,010.7	6,014.3	6,018.0	3.65
2,384	5,949.0	5,952.6	5,956.2	5,959.8	5,963.4	5,967.0	5,970.7	5,974.3	5,977.9	5,981.6	3.62
2,383	5,913.0	5,916.6	5,920.2	5,923.8	5,927.4	5,931.0	5,934.6	5,938.2	5,941.8	5,945.4	3.59
2,382	5,877.4	5,881.0	5,884.5	5,888.1	5,891.7	5,895.2	5,898.8	5,902.3	5,905.9	5,909.5	3.56
2,381	5,842.1	5,845.6	5,849.2	5,852.7	5,856.2	5,859.7	5,863.3	5,866.8	5,870.3	5,873.9	3.53
2,380	5,807.0	5,810.5	5,814.0	5,817.5	5,821.0	5,824.5	5,828.0	5,831.6	5,835.1	5,838.6	3.51
2,379	5,772.2	5,775.7	5,779.1	5,782.6	5,786.1	5,789.6	5,793.0	5,796.5	5,800.0	5,803.5	3.48
2,378	5,737.6	5,741.1	5,744.5	5,748.0	5,751.4	5,754.9	5,758.3	5,761.8	5,765.3	5,768.7	3.45
2,377	5,703.4	5,706.8	5,710.2	5,713.6	5,717.1	5,720.5	5,723.9	5,727.3	5,730.8	5,734.2	3.43
2,376	5,669.3	5,672.7	5,676.1	5,679.5	5,682.9	5,686.3	5,689.7	5,693.1	5,696.5	5,700.0	3.41
2,375	5,635.5	5,638.9	5,642.3	5,645.6	5,649.0	5,652.4	5,655.8	5,659.2	5,662.5	5,665.9	3.38
2,374	5,602.0	5,605.3	5,608.7	5,612.0	5,615.4	5,618.7	5,622.1	5,625.5	5,628.8	5,632.2	3.35
2,373	5,568.7	5,572.0	5,575.4	5,578.7	5,582.0	5,585.3	5,588.7	5,592.0	5,595.3	5,598.7	3.33
2,372	5,535.6	5,538.9	5,542.2	5,545.5	5,548.8	5,552.1	5,555.4	5,558.7	5,562.1	5,565.4	3.31
2,371	5,502.8	5,506.1	5,509.3	5,512.6	5,515.9	5,519.2	5,522.5	5,525.7	5,529.0	5,532.3	3.28
2,370	5,470.2	5,473.4	5,476.7	5,479.9	5,483.2	5,486.5	5,489.7	5,493.0	5,496.3	5,499.5	3.26
2,369	5,437.8	5,441.0	5,444.3	5,447.5	5,450.7	5,453.9	5,457.2	5,460.4	5,463.7	5,466.9	3.24
2,368	5,405.6	5,408.9	5,412.1	5,415.3	5,418.5	5,421.7	5,424.9	5,428.1	5,431.4	5,434.6	3.22
2,367	5,373.7	5,376.9	5,380.1	5,383.3	5,386.5	5,389.7	5,392.9	5,396.1	5,399.3	5,402.4	3.19
2,366	5,342.0	5,345.2	5,348.3	5,351.5	5,354.7	5,357.8	5,361.0	5,364.2	5,367.4	5,370.5	3.17
2,365	5,310.5	5,313.6	5,316.8	5,319.9	5,323.0	5,326.2	5,329.3	5,332.5	5,335.7	5,338.8	3.15
2,364	5,279.1	5,282.3	5,285.4	5,288.5	5,291.6	5,294.8	5,297.9	5,301.0	5,304.2	5,307.3	3.13
2,363	5,248.0	5,251.1	5,254.2	5,257.4	5,260.5	5,263.6	5,266.7	5,269.8	5,272.9	5,276.0	3.11
2,362	5,217.1	5,220.2	5,223.3	5,226.4	5,229.5	5,232.6	5,235.7	5,238.7	5,241.8	5,244.9	3.09
2,361	5,186.4	5,189.4	5,192.5	5,195.6	5,198.7	5,201.7	5,204.8	5,207.9	5,211.0	5,214.0	3.07
2,360	5,155.9	5,158.9	5,162.0	5,165.0	5,168.0	5,171.1	5,174.2	5,177.2	5,180.3	5,183.3	3.05
2,359	5,125.5	5,128.5	5,131.6	5,134.6	5,137.6	5,140.7	5,143.7	5,146.7	5,149.8	5,152.8	3.03
2,358	5,095.4	5,098.4	5,101.4	5,104.4	5,107.4	5,110.4	5,113.4	5,116.5	5,119.5	5,122.5	3.02
2,357	5,065.4	5,068.4	5,071.4	5,074.4	5,077.4	5,080.4	5,083.4	5,086.4	5,089.4	5,092.4	3.00
2,356	5,035.6	5,038.5	5,041.5	5,044.5	5,047.5	5,050.4	5,053.4	5,056.4	5,059.4	5,062.4	2.98
2,355	5,005.9	5,008.9	5,011.9	5,014.8	5,017.8	5,020.7	5,023.7	5,026.7	5,029.6	5,032.6	2.96
2,354	4,976.5	4,979.4	4,982.4	4,985.3	4,988.3	4,991.2	4,994.1	4,997.1	5,000.0	5,003.0	2.94
2,353	4,947.2	4,950.1	4,953.0	4,956.0	4,958.9	4,961.8	4,964.8	4,967.7	4,970.6	4,973.6	2.93
2,352	4,918.0	4,920.9	4,923.9	4,926.8	4,929.7	4,932.6	4,935.5	4,938.4	4,941.3	4,944.3	2.91
2,351	4,889.1	4,892.0	4,894.9	4,897.8	4,900.6	4,903.5	4,906.4	4,909.3	4,912.2	4,915.1	2.90
2,350	4,860.3	4,863.1	4,866.0	4,868.9	4,871.8	4,874.6	4,877.5	4,880.4	4,883.3	4,886.2	2.88
2,349	4,831.6	4,834.4	4,837.3	4,840.2	4,843.1	4,845.9	4,848.8	4,851.7	4,854.5	4,857.4	2.87
2,348	4,803.1	4,805.9	4,808.8	4,811.6	4,814.5	4,817.3	4,820.2	4,823.0	4,825.9	4,828.7	2.85
2,347	4,774.7	4,777.5	4,780.4	4,783.2	4,786.0	4,788.9	4,791.7	4,794.6	4,797.4	4,800.2	2.84
2,346	4,746.5	4,749.3	4,752.1	4,755.0	4,757.8	4,760.6	4,763.4	4,766.2	4,769.1	4,771.9	2.82
2,345	4,718.4	4,721.2	4,724.0	4,726.8	4,729.6	4,732.4	4,735.3	4,738.1	4,740.9	4,743.7	2.81



**Exhibit 12 – Mica Reservoir Storage/Elevation Table – Continued**

Elevation (feet)	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	Average Difference (per 0.1 ft)
2,344	4,690.5	4,693.3	4,696.1	4,698.8	4,701.6	4,704.4	4,707.2	4,710.0	4,712.8	4,715.6	2.79
2,343	4,662.7	4,665.4	4,668.2	4,671.0	4,673.8	4,676.5	4,679.3	4,682.1	4,684.9	4,687.7	2.78
2,342	4,635.0	4,637.8	4,640.5	4,643.3	4,646.1	4,648.8	4,651.6	4,654.4	4,657.1	4,659.9	2.77
2,341	4,607.4	4,610.2	4,613.0	4,615.7	4,618.5	4,621.2	4,624.0	4,626.7	4,629.5	4,632.2	2.76
2,340	4,580.0	4,582.8	4,585.5	4,588.2	4,591.0	4,593.7	4,596.5	4,599.2	4,602.0	4,604.7	2.74
2,339	4,552.7	4,555.4	4,558.2	4,560.9	4,563.6	4,566.4	4,569.1	4,571.8	4,574.6	4,577.3	2.73
2,338	4,525.5	4,528.2	4,530.9	4,533.6	4,536.4	4,539.1	4,541.8	4,544.5	4,547.3	4,550.0	2.72
2,337	4,498.3	4,501.0	4,503.7	4,506.5	4,509.2	4,511.9	4,514.6	4,517.3	4,520.0	4,522.8	2.72
2,336	4,471.2	4,473.9	4,476.6	4,479.3	4,482.0	4,484.7	4,487.5	4,490.2	4,492.9	4,495.6	2.71
2,335	4,444.2	4,446.9	4,449.6	4,452.3	4,455.0	4,457.7	4,460.4	4,463.1	4,465.8	4,468.5	2.70
2,334	4,417.3	4,420.0	4,422.6	4,425.3	4,428.0	4,430.7	4,433.4	4,436.1	4,438.8	4,441.5	2.69
2,333	4,390.4	4,393.1	4,395.8	4,398.4	4,401.1	4,403.8	4,406.5	4,409.2	4,411.9	4,414.6	2.69
2,332	4,363.6	4,366.3	4,368.9	4,371.6	4,374.3	4,377.0	4,379.7	4,382.3	4,385.0	4,387.7	2.68
2,331	4,336.9	4,339.6	4,342.2	4,344.9	4,347.6	4,350.2	4,352.9	4,355.6	4,358.2	4,360.9	2.67
2,330	4,310.2	4,312.9	4,315.6	4,318.2	4,320.9	4,323.6	4,326.2	4,328.9	4,331.6	4,334.2	2.66
2,329	4,283.7	4,286.3	4,289.0	4,291.6	4,294.3	4,296.9	4,299.6	4,302.3	4,304.9	4,307.6	2.66
2,328	4,257.2	4,259.8	4,262.5	4,265.1	4,267.8	4,270.4	4,273.1	4,275.7	4,278.4	4,281.0	2.65
2,327	4,230.8	4,233.4	4,236.1	4,238.7	4,241.3	4,244.0	4,246.6	4,249.3	4,251.9	4,254.5	2.64
2,326	4,204.5	4,207.1	4,209.7	4,212.3	4,215.0	4,217.6	4,220.2	4,222.9	4,225.5	4,228.1	2.63
2,325	4,178.2	4,180.8	4,183.4	4,186.1	4,188.7	4,191.3	4,193.9	4,196.6	4,199.2	4,201.8	2.63
2,324	4,152.0	4,154.6	4,157.2	4,159.9	4,162.5	4,165.1	4,167.7	4,170.3	4,173.0	4,175.6	2.62
2,323	4,125.9	4,128.5	4,131.2	4,133.8	4,136.4	4,139.0	4,141.6	4,144.2	4,146.8	4,149.4	2.61
2,322	4,099.9	4,102.5	4,105.1	4,107.7	4,110.3	4,112.9	4,115.5	4,118.1	4,120.7	4,123.3	2.61
2,321	4,074.0	4,076.6	4,079.1	4,081.7	4,084.3	4,086.9	4,089.5	4,092.1	4,094.7	4,097.3	2.59
2,320	4,048.1	4,050.7	4,053.3	4,055.9	4,058.4	4,061.0	4,063.6	4,066.2	4,068.8	4,071.4	2.59
2,319	4,022.3	4,024.9	4,027.5	4,030.0	4,032.6	4,035.2	4,037.8	4,040.4	4,042.9	4,045.5	2.58
2,318	3,996.6	3,999.2	4,001.8	4,004.3	4,006.9	4,009.5	4,012.0	4,014.6	4,017.2	4,019.7	2.57
2,317	3,971.0	3,973.6	3,976.1	3,978.7	3,981.3	3,983.8	3,986.4	3,989.0	3,991.5	3,994.1	2.56
2,316	3,944.8	3,947.3	3,949.9	3,952.4	3,955.0	3,957.6	3,960.1	3,962.7	3,965.2	3,967.8	2.55
2,310	3,794.0	3,796.5	3,799.1	3,801.6	3,804.1	3,806.6	3,809.2	3,811.7	3,814.2	3,816.7	2.53
2,280	3,083.5	3,085.9	3,088.2	3,090.6	3,093.0	3,095.3	3,097.7	3,100.1	3,102.4	3,104.8	2.37
2,240	2,279.6	2,281.6	2,283.6	2,285.6	2,287.6	2,289.6	2,291.7	2,293.7	2,295.7	2,297.7	2.01