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ATTORNEYS FOR THE IDAHO GROUND WATER APPROPRIATORS

BEFORE DEPARTMENT OF WATER RESOURCES

STATE OF IDAHO

IDAHO GROUND WATER APPROPRIATORS, INC., **Petitioners**	Docket No.: CM-MP-2009-06 **BRENDECKE AFFIDAVIT IN SUPPORT OF IGWA'S REQUEST FOR MITIGATION CREDIT FOR SURFACE WATER COALITION DELIVERY CALL**

STATE OF COLORADO)
ss:
County of BOULDER)

The undersigned, Charles M. Brendecke, having been first duly sworn upon oath does hereby depose and state as follows:

1. I am employed by Lynker Technologies, 5485 Conestoga Court Suite 220, Boulder, Colorado 80301. I am a Licensed Professional Engineer in Idaho, Colorado and Wyoming. I have a Bachelor of Science degree in Civil Engineering from the University of Colorado, and Master of Science and Doctor of Philosophy Degrees in Civil Engineering from

Stanford University. My education and professional experience are set forth in greater detail in my resume, which is attached hereto as Exhibit A. I have been for the past several years and continue to be the lead engineer and technical consultant to IGWA and its Ground Water District Members in conjunctive management matters.

2. Exhibit B contains my best estimate and opinion of the amount of reach gains for the near-Blackfoot to Minidoka reach of the Snake River ("Reach") from past mitigation activities performed by IGWA and other parties. The reach gains in Exhibit B are expressed in acre-feet.

3. The estimates in Exhibit B were prepared by me using information from previous groundwater modeling by the Department and from information obtained from the Department and others concerning ongoing mitigation and aquifer management activities. This information was used with version 2.1 of the ESPAM to estimate 2015 irrigation season (April through October) gains to the reach of the Snake River. The procedures used to develop each entry in Exhibit B are described more fully below.

4. Since 2010, the Department has performed groundwater modeling to quantify the mitigation credit allowed IGWA for its past and ongoing aquifer enhancement activities. The findings of the first of these modeling efforts were contained in the Director's Final Order Approving Mitigation Credits Regarding SWC Delivery Call, dated July 19, 2010 ("July 19th Order"). Most recently the Department did a series of model runs for a post-audit of the 2015 credits from historical aquifer enhancement activities credits as they related to the Rangen Delivery Call and Mitigation Plan. I have obtained from the Department the model input files and results from its previous mitigation credit analyses as part of the basis for my estimate of the 2015 credits shown in Exhibit B.

5. The estimate of 2015 credit from IGWA's CREP program was derived by calculating the area of the CREP land and applying the average annual or monthly Crop Irrigation Requirement (CIR) as defined in the ESPAM2_CIR_GWadjusted.layer to determine the average annual and monthly volume of aquifer benefit from the foregone groundwater use. The ESPAM v2.1 was then run in transient mode (SuperTran) to estimate the 2015 irrigation season and average annual reach gains accruing from IGWA's historical CREP activity within the area of common groundwater. CREP benefits within the A&B and Southwest & Goose Creek Irrigation districts were modeled separately.

6. The estimate of 2015 credit from IGWA's historical conversion activities in Water District 130 were derived by calculating the total volume of aquifer benefit based on the average annual mitigation volumes in the Department's 2014 post-audit run and applying them uniformly over the irrigation season using monthly stress periods. The ESPAM v2.1 was then run in transient mode to estimate the 2015 irrigation season reach gains accruing to the Reach from IGWA's historical conversions activity within the area of common groundwater. Conversions within the A&B and Southwest & Goose Creek Irrigation districts were modeled separately.

7. The estimate of 2015 credit to the Reach from IGWA's historical recharge activities was based on the average annual recharge volume for 2007 and 2009 from the Department's 2014 post-audit run applied as a weighted volume for monthly stress periods using the recharge dates of October 20 through November 27, 2007 and October 22 through November 17, 2009.

8. Exhibit B also contains estimates of 2015 irrigation season reach gains attributable to historical CREP and conversion activities in the Southwest Irrigation District, the

Goose Creek Irrigation District and the A&B Irrigation District. These estimates were derived using similar approaches to those described above for IGWA's aquifer enhancement activities.

9. Exhibit B does not contain any estimate of the 2015 irrigation season reach gains that will occur as a result of recharge projects undertaken by the Idaho Water Resource Board. However, this recharge also creates gains to the Reach that are part of the SWC water supply.

10. Exhibit B also contains an estimate of the reach gains from November 2015 through March 2016 that will occur as a result of the historical aquifer enhancement activities described in the foregoing paragraphs.

11. Some refinement of the estimates in Exhibit B is possible as additional information is gathered, but it is my belief that such refinements will not materially change the estimates.

Further, your Affiant saith not.

Dated: April 30, 2015.

CHARLES M. BRENDECKE

Subscribed to and sworn to before me, a Notary Public, this 30th day of April, 2015.

Notary Public for
Residing at 2100 W Main St
My commission expires 10-01-2017

BONNIE LAMOREAUX
NOTARY PUBLIC
STATE OF COLORADO
NOTARY ID 20094032102
MY COMMISSION EXPIRES OCTOBER 1, 2017

Charles M. Brendecke, PhD, PE

Senior Consultant

Professional Summary

Dr. Brendecke has more than 40 years of diverse experience in hydrology, water rights, water resources engineering, and water resources planning and management. He has directed a wide variety of projects addressing local and regional water supply planning; management of complex water supply systems; simulation modeling of surface and groundwater systems (including water right administration); municipal and agricultural water demand forecasting and conservation; and water rights development and transfer. His work as lead expert in a variety of water rights proceedings includes historical consumptive use analysis, evaluation of surface/groundwater interactions, conjunctive administration of surface and groundwater rights, development of protective terms and conditions, settlement negotiations, and expert witness testimony. He has been qualified as an expert witness in numerous venues, including the U.S. Supreme Court.

Summary of Core Skills: Hydrology; Water rights; Water supply planning /management; Surface/ground water interaction; Reservoir system operations; computer modeling of surface and groundwater systems; Statistical hydrology; Negotiation/litigation support; Expert witness testimony.

Education

-Ph.D., Civil Engineering, Stanford University, Stanford, California/USA, 1979.
-M.S., Civil Engineering, Stanford University, Stanford, California/USA, 1976.
-B.S., Civil Engineering, University of Colorado, Boulder, Colorado/USA, 1971.

Years of Experience ~40

Professional Affiliations

-Professional Engineer (PE), CO #17578, 1980
-Professional Engineer (PE), WY #6960
-Professional Engineer (PE), ID #11896
-American Society of Civil Engineers
-American Water Resources Association
-Public Policy Mediation Training – CDR Associates, Boulder, Colorado/USA, 2004.

Employment History

Lynker Technologies, Senior Consultant, 2015-present
AMEC Environment & Infrastructure, Principal, Boulder, Colorado, 2007 – 2015
Hydrosphere Resource Consultants, Inc., Principal and President, Boulder, Colorado, 1986 to 2007
Wright Water Engineers Inc., Senior Project Engineer, Denver, Colorado, 1985 – 1986.
University of Colorado, Assistant Professor of Civil Engineering, Boulder, Colorado, 1979 – 1985
Institute for Arctic and Alpine Research, Faculty Research Associate, Boulder, Colorado, 1979 – 1985
Independent Water Consultant (various clients), Boulder, Colorado, 1979-1985
Stanford University, Research Assistant and Lecturer, Stanford, California, 1975 – 1979
Wright-McLaughlin Engineers, Inc., Design Engineer, Denver, Colorado, 1973 – 1975

Detailed Skills by Representative Project

Conjunctive Administration of Ground Water Rights, Idaho Ground Water Appropriators, Inc., Boise, Idaho
Project manager and testifying expert. Testified in proceedings related to administration of surface and groundwater rights. Work has involved oversight of regional ground water model development of the Eastern Snake Plain Aquifer, groundwater modeling in support of management and mitigation plans, and analysis of historical water use data.

Rio Grande Basin Groundwater Management, Conejos Water Conservancy District, Manassa, Colorado
Project Manager and Testifying expert. Testified regarding proposed methods for replacement of injurious depletions caused by groundwater pumping in Special Improvement District No. 1 of the Rio Grande Water Conservation District and regarding the use of the RGDSS groundwater model in developing rules governing new withdrawals from the confined aquifer system of the San Luis Valley.

Laramie County Hydrogeologic Study, Wyoming State Engineer Office, Cheyenne
Principal in Charge. Work involved development of groundwater model to evaluate sustainability of current groundwater pumping in an alluvial basin, Wyoming.

Horse Creek Groundwater Investigations, Wyoming State Engineer Office, Cheyenne
Project Manager. Work involved development of groundwater model to evaluate relationships between groundwater pumping and surface water supplies in an alluvial basin, Wyoming.

City of Boulder Water Rights, Boulder, CO
Expert witness. Work involved preparation of expert reports and technical assistance in settlement of water rights claims on the South Platte River, Colorado.

Long Range Water Demand Projections, Colorado Springs Utilities, Colorado Springs
Project Manager. Work involved preparation of long range water demand forecasts and submittal of expert report in support of water rights claims. Colorado

Land Application (Spray Field) Plan for Wastewater Disposal, Tessenderlo-Kerley, Inc.
Project Manager. Work involved development of land treatment plan for agricultural products facility near Kennewick, Washington.

Long Range Water Demand Forecast, Idaho Water Resource Board, Boise
Project Manager. Work involved development of long-range water demand forecasts for Rathdrum Prairie Aquifer, Idaho.

Golf Resort Water Management, The Valley Club, Sun Valley, Idaho
Project manager. Work involved water supply planning and water rights transfers for golf resort.

Interstate Water Litigation, North Carolina Department of Justice, Raleigh, North Carolina
Project Manager. Work involved hydrology, water supply and reservoir operations studies.

Municipal Water Storage Planning, Colorado Springs Utilities, Colorado Springs, Colorado
Project manager. Lead a reconnaissance-level evaluation of potential water storage projects for major municipal water utility in southern Colorado.

Spear T Ranch v. Knaub, et.al., Hageman and Brighton, Attorneys, Morrill County, Nebraska
Project manager. Performed groundwater modeling analysis regarding effects of pumping on surface flows at points of diversion on Pumpkin Creek in Morrill County, Nebraska.

Columbia River Basin Reservoir Operations, Busch Agricultural Resources, Inc., Kootenai Valley, Idaho
Project manager. Performed studies of the impact of modified reservoir operations on agricultural interests in the Kootenai River basin.

New Mexico Surface Water Studies
Project manager. Performed a program of surface and ground water studies on the Pecos River in support of State initiatives.

Interstate Compact Litigation, Colorado Division of Water Resources, Denver, Colorado
Expert witness. Testified in litigation between Kansas and Colorado regarding Arkansas River water uses.

Interstate Compact Litigation, Wyoming Attorney General, Cheyenne, Wyoming
Project manager and expert witness. Testified in litigation between Nebraska and Wyoming regarding storage project operations and water deliveries to agricultural users on the North Platte River.

Rio Grande Decision Support System, Colorado Division of Water Resources, Denver, Colorado
Quality assurance officer. Developed a comprehensive surface water model of the Rio Grande River basin in Colorado.

Agricultural Water Conservation, U.S. Bureau of Reclamation, Denver, Colorado
Project manager. Developed a water conservation guidebook for use by irrigation districts. The guidebook describes planning approaches and methods for evaluating specific conservation measures.

Colorado City Metropolitan District
Project manager. Performed water supply planning studies and water rights litigation support for municipal water provider.

Gunnison Basin Planning Model
Project manager. Developed an interactive PC-based computer model of hydrology and water rights administration in the Gunnison River basin. The model uses a network solution algorithm and incorporates a Windows™-based interface.

Yampa River Basin Planning Studies, Colorado River Water Conservation District, Glenwood Springs, Colorado
Project manager. Performed a comprehensive water supply planning study that included demand forecasting, development of a basin computer model, and evaluation of potential water storage project operations.

Snake River Basin Water Supply Study
Project manager. Performed a comprehensive review of water use in the Snake River basin and computer model evaluation of potential water management strategies, including agricultural water conservation, to enhance anadromous fisheries.

Upper Colorado River Water Rights, Colorado River Water Conservation District, Glenwood Springs, Colorado
Performed engineering analysis of the historical use of irrigation rights located on the Blue River, determining the portion of consumptive use made possible by Green Mountain Reservoir releases. Analyzed the historical consumptive use of the irrigation water rights associated with the Gary Hill Ranch on Muddy Creek, in support of water rights acquisition associated with the construction of Muddy Creek Reservoir.

Summit County Small Reservoir Study, Colorado Water Conservation Board, Denver, Colorado
Project manager. Performed a water management study for the Blue River basin involving development of a hydrologic model and evaluation of new storage facilities for instream flow maintenance.

Gunnison Basin Planning Study, Colorado River Water Conservation District, Glenwood Springs, Colorado
Project manager. Developed a detailed hydrology and water rights model of the 8000 square mile Gunnison River basin as part of a comprehensive river basin planning study.

Windy Gap Delivery Study, City of Boulder, Boulder, Colorado
Project manager. Developed detailed computer models of Colorado-Big Thompson Project operations to support analysis of the yields of the Windy Gap Project, which shares common facilities.

Superconducting Super Collider Water Supply, State of Colorado
Project manager. Determined industrial water needs and developed the water supply strategy for a proposed Department of Energy physics research facility.

Boulder Raw Water Master Plan, City of Boulder, Boulder, Colorado
Prepared a comprehensive report concerning water rights holdings and water supply system operating policies for a Front Range municipality of 100,000 persons.

Standley Lake Pollutant Loading
Project manager. Developed hydrologic and pollutant loading model of Standley Lake to assess relative effects of non-point sources and a proposed effluent exchange by a major industrial water user.

Pecos River Compact
Consultant to the Special Master of the U.S. Supreme Court. Advised on technical issues in a lawsuit between Texas and New Mexico concerning river depletions and water deliveries.

Rocky Ford Ditch Transfer
Project manager. Performed engineering analyses of historic irrigation practices and Arkansas River depletions associated with a 4100-acre tract in southeastern Colorado.

Buena Vista Water Rights
Project manager. Analysis of the historic use of irrigation water rights and development of engineering data supporting their transfer to municipal use.

Dillon Clean Lakes Study
Project manager. Development of a comprehensive hydrologic monitoring network to determine lake inflow patterns and non-point source pollutant loadings from various land uses.

Restoration of West Tenmile Creek
Project manager. Performed hydrologic and hydraulic analysis and design of comprehensive stream habitat improvements at Copper Mountain ski area.

LYNKER TECHNOLOGIES

Publications and presentations

"Surface/Groundwater Interaction", presentation to North Idaho Water Law Conference, July 28-29, 2014, Couer d'Alene, Idaho

t"Climate Change and Water Supply Planning in Colorado," Rozaklis, L., B. Harding and C. Brendecke, presentation at Annual Water Resources Conference, American Water Resources Association, Nov 6-10, 2011. Albuquerque, New Mexico.

"Toward Conjunctive Management of the Eastern Snake Plain Aquifer," poster presentation, by Charles Brendecke at Natural Resources Law Center 25th Summer Conference Groundwater in the West, Boulder, Colorado, June 16-18, 2004.

"Interstate Water Conflict: Compacts, Adjudications and Decrees," Charles Brendecke, Water Policy Seminar: Freshwater Conflicts in the United States, Stanford, California, May 19, 2004.

"Water Rights, Compact Entitlements and Endangered Fishes of the Yampa River Basin," Brendecke, C., and R.D.Tenney, Proceedings of the Annual Water Resources Conference, American Water Resources Association, November 12-15, 2001. Albuquerque, New Mexico.

"Conjunctive Management: Science or Fiction?" Brendecke, Charles M., presentation to Idaho Water Users Association 18th Annual Water Law and Resource Issues Seminar, November 8-9, 2001. Boise, Idaho.

"Planning for Water Development and Endangered Species Recovery in the Yampa River Basin." Tenney, Ray D., and C.M. Brendecke, Proceedings of the Wetlands Engineering & River Restoration Conference, American Society of Civil Engineers, March 26, 1998, Denver, Colorado.

"Agricultural Water Conservation Planning & Pricing-Tools & Technologies." Payton, E., C. Brendecke, B. Harding, E. Armbruster, T. McGuckin and C. Huntley. Proceedings of the Irrigation Association's 18th International Conference, November 2, 1997, Nashville, Tennessee.

"Achieving Efficient Water Management: Hydrosphere Resource Consultants, Inc., Agricultural Water Conservation Planning," workshop for U.S. Bureau of Reclamation staff, December 16 - 18, 1996. Las Vegas, Nevada.

"PC-Based Decision Support Tools: Lessons from a Dozen Applications," Brendecke, C., B. Harding and E. Payton, Proceedings of the Fifth Water Resources Operations Management Workshop, Water Resources Planning and Management Division (ASCE). March 4, 1996. Arlington, Virginia.

"The Value of Water Supply Reliability in Urban Water Systems," Howe, C.W., M. Smith, L. Bennett, C. Brendecke, J. Flack, R. Hamm, R. Mann, L. Rozaklis, and K. Wunderlich, Journal of Environmental Economics and Management, 1994. v. 26, pg. 19-30.

"Managing Snake River Operations for Juvenile Salmon Migration," Brendecke, C. Proceedings of the ASCE Water Resource Planning and Management Conference Division 20th Anniversary Conference, Seattle, Washington, May, 1993.

"The Hydrosphere Snake River Operations Model", Brendecke, C., 9th Annual Water Law and Resource Issues Seminar, Idaho Water Users Association, Boise, Idaho. 1992.

"Logical Intransitivities and Other Administrative Nightmares: Can Models Help?," Brendecke, C., and B. Harding. Proceedings of the 26th Annual AWRA Conference and Symposium, November 4-9, 1990. Denver, Colorado.

"Legal and Economic Disincentives in the Transfer of Models to Users," Harding, B., C. Brendecke, and R. Kerr. Proceedings of the 26th Annual AWRA Conference and Symposium, November 4-9, 1990. Denver, Colorado.

"Network Models of Water Rights and System Operations," Brendecke, C., W. DeOreo, E. Payton, and L. Rozaklis. Journal of the Water Resources Planning and Management Division (ASCE). 1989.

"Modeling Water Allocation Problems Under Complex Hydrologic and Institutional Settings," Rozaklis, L., E. Payton, C. Brendecke, and B. Harding, paper presented at the 24th Annual AWRA Conference and Symposium, November 8, 1988. Milwaukee, Wisconsin.

"Water Rights Analysis and System Operation Using Network Optimization Models," Brendecke, C., W. DeOreo, and L. Rozaklis, paper presented at the 14th Annual ASCE Water Resources Planning and Management Division Conference, March 16-18, 1987. Kansas City.

"Network Optimization Models for Water Rights Analysis and System Operating Studies for the City of Boulder," Brendecke, C., E. Payton, and R. Wheeler, Proceedings of the Colorado Water Engineering and Management Conference, February 17-18, 1987. Ft. Collins, Colorado.

"Rainfall and Snowmelt Frequency in an Alpine Watershed," Payton, E., and C. Brendecke, Proceedings of the 53rd Western Snow Conference, April 16-18, 1985. Boulder, Colorado, pp. 25-36.
"A Simulation Model of Boulder's Alpine Water Supply," Brendecke, C., and J. Sweeten, Proceedings of the 53rd Western Snow Conference, April 16-18, 1985. Boulder, Colorado, pp. 63-71.
"The Redistribution and Sublimation Loss of Snowpack in an Alpine Watershed," James, E., and C. Brendecke, Proceedings of the 53rd Western Snow Conference, April 16-18, 1985. Boulder, Colorado, pp.148-151.
"Comparison of Two Daily Streamflow Simulation Models of an Alpine Watershed," Brendecke, C., D. Laiho, and D. Holden, Journal of Hydrology, 1985, v. 77, pp. 171-186.
"Management of a Municipally Owned Alpine Watershed Using Continuous Simulation," Brendecke, C., D. Laiho, and J. Sweeten, Proceedings of the 11th International Symposium on Urban Hydrology, Hydraulics, and Sediment Control, July 23-26, 1984. Lexington, Kentucky, pp. 79-87.
Eutrophication and Land Use, Lewis, W., D. Crumpacker, J. Saunders, and C. Brendecke, Ecological Studies Vol. 46, Springer-Verlag, 1984. New York, 202 pp.
"A Comparative Evaluation of Streamflow Simulation Models in a Colorado Alpine and Subalpine Environment," Brendecke, C., D. Laiho, and D. Holden, Proceedings of the American Geophysical Union Front Range Branch Hydrology Days, April 24-26, 1984. Ft. Collins, Colorado, pp. 40-55.
"Seepage from Oilfield Brine Disposal Ponds in Utah," Baker, F., and C. Brendecke, Groundwater, 1983. 21(3), pp. 317-324.
"Environmental Considerations in Corps Planning," Brendecke, C., and L. Ortolano, Water Resources Bulletin, 1981. 17(2), pp. 248-254.

Exhibit B. Predicted impact of 2005 through 2014 aquifer enchancement projects on 2015-2016 reach gains to nr Blackfoot to Minidoka

Mitigation project	Volume (AF/yr)[8]											Predicted average benefit to nr Blackft to Minidoka Reach Gains (af)[9]			
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Future years[8]	Irrigation Season April 2015-October 2015[10]	Non-Irrigation Season November 2015-March 2016[10]	Average Annual (4/2015-3/2016)[11]	Impact of 2014 projects at steady state
IGWA Conversions[1]	29,161	35,250	36,915	35,967	13,562	17,210	23,307	30,144	24,335	30,480	0	1,810	1,336	2,813	7,013
SWID Conversions[2]	0	0	0	0	0	47,138	47,189	58,909	47,350	45,622	0	4,003	3,064	6,309	15,657
ABID Conversions[3]	4,553	4,553	4,553	4,553	3,884	3,240	3,271	4,772	3,930	3,715	0	595	426	955	1,281
SWID Voluntary Curtailment[4]	0	0	0	0	0	4,211	4,015	4,015	3,946	3,946	0	312	242	483	1,312
IGWA CREP[5]	0	0	33,957	44,320	44,231	35,391	35,391	33,552	33,139	32,106	0	6,726	3,914	9,990	17,419
SWID CREP[5]	0	0	0	0	0	1,588	1,588	1,588	1,588	1,588	0	121	94	188	524
ABID CREP[5]	0	0	0	0	0	0	0	0	0	242	0	10	7	14	103
IGWA Recharge[6]	0	0	27,360	0	13,687	0	0	0	0	0	0	302	199	477	-
SWID Recharge[7]	0	0	0	0	0	0	0	1,195	1,169	453	0	23	40	63	152
IGWA	29,161	35,250	98,232	80,287	71,480	52,601	58,698	63,696	57,474	62,586	0	8,838	5,449	13,280	24,432
SWID/GCID	0	0	0	0	0	52,936	52,792	65,706	54,053	51,609	0	4,459	3,440	7,043	17,644
ABID	4,553	4,553	4,553	4,553	3,884	3,240	3,271	4,772	3,930	3,956	0	605	433	969	1,385
Total	33,714	39,803	102,785	84,840	75,364	108,777	114,761	134,174	115,457	118,151	0	**13,902**	**9,322**	**21,292**	**43,461**

Notes:

1. IGWA conversion volume includes water delivered to conversion projects, excess water delivered to conversion projects, canal seepage within NSCC and AFRD2 delivery systems, and voluntary idle projects. For 2005-2014, canal seepage was
2. SWID conversion volume includes water delivered to conversion projects and canal seepage of 38% within the J Canal delivery system.
3. ABID conversion volume includes water delivered to conversion projects and canal seepage of 15% within the delivery system.
4. SWID voluntary curtailments on mixed source lands where groundwater irrigation is supplemental to surface water irrigation were assigned a groundwater fraction of 0.88 for calculation of idled acres and volume of benefit to the aquifer.
5. 2007-2009 IGWA CREP may include land located within SWID/GCID. Beginning in 2010, CREP land located within SWID/GCID is simulated separately. 2007-2013 IGWA CREP may include lands enrolled by ABID. Beginning in 2014, CREP lands
6. IGWA recharge does not include recharge sponsored by IWRB or recharge outside of the Great Rift trim line.
7. SWID recharge is not intended to include recharge sponsored by IWRB. Unable to verify whether or not SWID recharge claimed for 2012 and 2013 was sponsored by IWRB.
8. Predicted average benefit does not consider potential benefits of aquifer enhancement activities that may occur in future years.
9. Predicted benefits to the model reach were calculated using transient and steady state, superposition versions of ESPAM2.1.
10. Mitigation volumes were modeled with monthly stress periods over an eleven-year model period (2005-2016) beginning April 1, 2005.
11. Mitigation volumes were modeled at an average constant rate distributed over a one-year period beginning April 1.