Water Solutions, Inc.

Technical Memorandum

To: Craig Horrell, Chair Basin Study Work Group
Mike Britton, Chair, Deschutes Basin Board of Control

From: Adam Sussman, GSI Water Solutions, Inc.
Owen McMurtrey, GSI Water Solutions, Inc.
Kim Grigsby, GSI Water Solutions, Inc.

Date: January 12, 2017

Re: Task 6 - Groundwater Mitigation under the Deschutes Basin Groundwater Mitigation Program; A Summary of Projected Supply and Demand

Executive Summary

As part of the Upper Deschutes River Basin Study (Basin Study), GSI Water Solutions, Inc. (GSI) was tasked with evaluating water right, legal and policy opportunities and impediments associated with groundwater mitigation under the Deschutes Basin Groundwater Mitigation Program. Information compiled through this effort will be combined with other Basin Study information to develop water resources management scenarios that can be evaluated for benefits, costs, and feasibility.

There is a hydraulic connection between groundwater and surface water in the Deschutes Basin and, consequently, new permitted uses of groundwater affect existing surface water rights and state scenic waterways. The Deschutes Groundwater Mitigation Program was established to create a mechanism for allowing new uses of groundwater while mitigating impacts to scenic waterway flows and senior surface water rights. (See Deschutes Basin Program at OAR 690-505-0500). Before issuing a new groundwater right, the Oregon Water Resources Department (OWRD) determines the amount of mitigation, the stream, and the location where the mitigation must be provided. The mitigation, referred to as "mitigation water," is water that is legally protected instream either through an instream lease (to create a temporary credit) or an instream transfer (to create a permanent credit). Although mitigation must generally be provided before OWRD will issue a new groundwater, municipal and quasi-municipal water providers can "incrementally mitigate" by providing additional mitigation as they increase the use of water under their groundwater permits (under an approved incremental mitigation plan).

GSI projected the demand for permanent mitigation credits during the next 20 years and the next 50 years. GSI also estimated the current supply of permanent mitigation credits. This memorandum considers the projected demand for permanent mitigation credits.

20-Year Projected Demand

GSI estimated the demand for permanent mitigation during the next 20 years to be approximately 13,233 mitigation credits. To estimate this demand, GSI considered the following:

- Existing permits that require mitigation but for which mitigation has not yet been provided;
- Mitigation obligations that are currently being met with temporary credits; and
- Mitigation that is expected to be required for permits that will be issued in the next 20 years.

50-Year Projected Demand

GSI also projected demand for permanent mitigation credits for new water rights to be issued from 2036 through 2065. This demand was estimated to be between 6,280.9 and 8165.7 credits. This projected mitigation demand was developed by considering:

- Projected new municipal water demand within the urban growth boundaries for the cities of Bend, Sisters and La Pine; and
- Mitigation required by new groundwater rights issued for uses other than municipal/quasi-municipal supply.

The total demand for permanent mitigation credits during the next 50 years is, therefore, projected to be between 19,513.9 and 21,398.8 credits.

Finally, GSI developed an estimate of the permanent mitigation supply expected to be available to meet the demand for mitigation. GSI obtained data from OWRD about existing unused credits and pending instream water right transfers that are expected to generate mitigation credits. The result was a projected supply of 551.2 mitigation credits.

After considering the supply of permanent mitigation credits and the 50-year demand for permanent mitigation, there is a projected need for approximately 18,962.7 to 20,847.6 permanent mitigation credits. All of this information is summarized in the table below.

Table ES.1 Groundwater Mitigation Summary - Projected Supply and Demand

	Permanent Mitigation Credits
20-Year Projected Demand (2016—2035)	13,233.0
50-Year Projected Demand (2036—2065)	6,280.9 – 8165.7
Total Projected Demand through 2065	19,513.9 – 21,398.8
Projected Mitigation Supply	551.2
Total Projected Mitigation Need (2016—2065)	18,962.7 – 20,847.6

1. Introduction

As part of the Upper Deschutes River Basin Study (Basin Study), GSI Water Solutions, Inc. (GSI) was tasked with evaluating water right, legal and policy opportunities and impediments associated with groundwater mitigation under the Deschutes Basin Groundwater Mitigation Program. Specifically, GSI's Task 6 is to summarize current demand and supply for groundwater mitigation and to develop a 20-year and 50-year demand projection for groundwater mitigation. Based on this analysis, GSI found a 20-year projected mitigation demand of approximately 13,233.0 mitigation credits (acre-feet) and a 50-year projected mitigation demand of approximately 19,513.9 to 21,398.8 mitigation credits.

Finally, this memorandum also describes potential options for establishing groundwater mitigation credits that are reliable, cost effective and efficient. Information from this memo will be combined with other Basin Study information to develop water resources management scenarios that can be evaluated for benefits, costs, and feasibility.

2. Background

In 1993, the U.S. Geological Survey and the Oregon Water Resources Department (OWRD) initiated a study on the groundwater in the Deschutes Basin above Lake Billy Chinook (Ground Water Hydrology of the Upper Deschutes Basin, Oregon Water Resources Investigation Report 00-4162, Portland, Oregon 2001.) One of the conclusions of the study is that there is direct hydraulic connection between groundwater and surface water within the study area. As a result of this conclusion, OWRD determined that groundwater appropriations within the study area would interfere with existing surface water rights (including instream water rights) and would measurably reduce flows needed for scenic waterways in the Deschutes Basin. Under the Scenic Waterway Act (ORS 390.835) OWRD could only approve new groundwater permits if qualifying mitigation was provided.

In 2002, the Deschutes Basin Groundwater Mitigation Program was established to create a mechanism for water users to provide mitigation for impacts to scenic waterway flows and senior water rights, while allowing additional appropriations of groundwater in the Deschutes Ground Water Study Area (See Figure 1 attached). The mitigation program is authorized by ORS 537.746 and is established in OWRD's rules (Oregon Administrative Rules (OAR) Chapter 690, Divisions 505, 521 and 522.) The current mitigation program rules allow only 200 cubic feet per second (cfs) of new groundwater use. Under current law, the program is scheduled to sunset on January 2, 2029.

Before issuing a new groundwater right, OWRD determines the amount of mitigation and the location where the mitigation must be provided. The amount of mitigation (mitigation obligation) is the anticipated annual volume, in acre-feet of consumptive use that would occur under the water right. The mitigation, referred to as "mitigation water" is water that is legally protected instream, calculated in an annual volume (acre-feet). One acre-foot of water protected instream equals one mitigation credit. Generally, mitigation water has come from transferring instream existing irrigation water rights. Mitigation can be permanent, through mechanisms such as an instream transfer, or temporary through mechanisms such as an instream lease. If permanent mitigation is provided, the rules require a one to one offset of consumptive use of the water right. If temporary mitigation is provided, the rules require that mitigation equal double the consumptive use.

The location (zone of impact) is the portion of the Study Area where the primary impact to surface water will occur. (See Figure 2 attached for established zones of impact). Generally, an applicant for a new groundwater permit must provide the identified amount of mitigation from the identified zone of impact prior to OWRD issuing a permit. The exception to this requirement, is that municipal and quasi-municipal permit holders may establish an incremental mitigation plan that allows them to satisfy their mitigation obligation over time by incrementally providing mitigation as they develop their water right.

Note: Much of the information for the mitigation demand projections was retrieved from OWRD's Water Rights Information System (WRIS) on May 20, 2016. Data used in this analysis was the best information available at the time. The WRIS database is continually updated as water rights applications are processed by OWRD. Consequently, the analysis reflects the data that was available as of May 20, 2016 and does not consider any changes in WRIS since that date.

3. Short-Term (20-year) Mitigation Demand and Mitigation Supply

As an initial step, GSI projected the demand for permanent mitigation under the Deschutes Basin Groundwater Mitigation Program over the next 20 years, and then assessed the supply of existing mitigation that is currently available to meet these demands.

3.1 Short-Term Mitigation Demand

To assess the demand for mitigation during the 20-year period of 2016 to 2035, GSI considered both the currently identified demand for mitigation and the anticipated addition demand during this time period.

3.1.1 Currently Identified Mitigation Demand

Based on information provided by OWRD, the total currently identified mitigation demand was estimated by summing the existing mitigation obligations for specific categories of permit applications and permits for the use of groundwater within the Deschutes Study Area. **Table 3.1** provides a summary of the currently identified mitigation demand, which was determined to be 3,562.6 credits.

GSI included in the 20-year mitigation demand projection, the amount of mitigation currently met with temporary credits. The assumption is that over time groundwater permit holders using temporary credits would switch to permanent mitigation credits to ensure the security of their water right.[1] Thus the amount of mitigation obligation currently being met with temporary credits represents another current demand for (permanent) mitigation credits. A summary of the mitigation obligation for permits that has been met with temporary mitigation credits is provided in **Table 3.2**. A total of 400.2 temporary credits are expected to represent a demand for permanent credits.

[1] Although experience shows that not all groundwater permit holders using temporary credits ultimately acquire permanent mitigation credits, this assumption provides a conservative approach to estimating demand for permanent credits.

Table 3.1: Mitigation obligations for pending groundwater permit applications and groundwater permit applications with final orders for which mitigation has not yet been provided (as of December 31, 2015).[2] Units shown are mitigation credits.

Zone of Impact	Municipal and Quasi-Municipal	Irrigation	Commercial	Storage (Including Pond Maintenance)	Nursery
General	1532.5	803.7	0.6	-	9
Crooked River	868.8	271.9	-	-	-
Metolius River	24.1	17.4	3.2	1.9	-
Whychus Creek	-	6.9	-	-	-
Middle Deschutes River	-	5.4	-	-	-
Upper Deschutes River	-	-	-	-	-
Little Deschutes River	17.2	-	-	-	-

Total Credits: 3,562.6

Table 3.2: Mitigation obligation for groundwater permits for which the mitigation obligation has been met with temporary credits. Units shown are mitigation credits.[3]

Zone of Impact	Irrigation	Agriculture	Commercial	Storage (Including Pond Maintenance)
General	121.7	9.8	5.9	3.7
Crooked River	20.3	-	-	-
Metolius River	-	-	-	-
Whychus Creek	188.8	-	-	-
Middle Deschutes River	27.0	-	-	-
Upper Deschutes River	7.2	-	-	-
Little Deschutes River	2.0	-	-	13.9

Total Credits: 400.2

The final component of the currently identified mitigation demand is municipal and quasi-municipal water rights with a remaining mitigation obligation under their incremental mitigation plans. GSI reviewed the incremental mitigation plans and identified the amount of mitigation each entity is projected to require prior to 2036.[4] This demand for mitigation was reduced by the number of

[2] GSI only considered applications for which the mitigation obligation had been determined prior to December 31, 2015. Applications submitted prior to December 31, 2015, but for which OWRD had not developed an Initial Review or Notice of Mitigation Obligation were not considered. Additionally, information on permit status was obtained using data from OWRD's Water Rights Information System on May 20, 2016. Therefore, if an application had received an Initial Review or Notice of Mitigation Obligation prior to December 31, 2015, but was withdrawn, denied, or approved prior to May 20, 2016, it was not included in table 3.1. As appropriate, these applications were included in calculations for Tables 3.2, 3.3, and 3.4.

[3] Municipal use is not included in Table 3.2 because municipal and quasi-municipal permits meeting mitigation obligation with temporary credits are accounted-for in Table 3.3.

[4] GSI included all mitigation included in increments that began prior to January 1, 2036.

permanent mitigation credits that had already been provided. (Consistent with the approach described above, temporary credits were not considered to reduce the 20-year demand for mitigation credits.) The portions of the incremental mitigation plans for which permanent mitigation has not yet been provided was further reduced by "unassigned and pending credits." Unassigned and pending credits includes pending permanent instream transfers; mitigation credits held by a municipal or quasi-municipal groundwater permit holder, but not yet assigned to a permit requiring mitigation; and mitigation credits not held by a municipal or quasi-municipal groundwater permit holder, but that GSI is aware (based on information provided by OWRD) are associated with a specific municipal or quasi-municipal groundwater permit holder..[5] For example, if a water provider has filed an application to transfer a water right instream, their projected mitigation demand was reduced by the number of credits they are anticipated to receive.

Table 3.3 summarizes the results of the above-described process to estimate the currently identified mitigation demand for municipal and quasi-municipal water suppliers within the next twenty years. For each municipal and quasi-municipal water provider, the table provides the water provider's estimated mitigation demand based on its incremental mitigation plan(s). The table also lists credits that reduce this demand: the permanent credits supplied and any unassigned or pending credits that the water provider will obtain; as well as temporary credits that did not reduce the demand). The result is an estimated 20-year mitigation demand for each water provider, and an estimated total 20-year mitigation demand of 7,660.7 credits.

[5] Although some municipal and quasi-municipal water providers hold water rights for irrigation purposes, it was not assumed that these water rights would be used to obtain mitigation credits because each situation has a unique set of factors including the potential requirement to obtain a district's approval or a city government's approval for the transaction, and a need to use the water right for irrigation purposes.

Table 3.3: Municipal and quasi-municipal water suppliers with groundwater permits requiring mitigation, the zone of impact of their water rights, permanent and temporary credits supplied, unassigned and pending credits, and mitigation demand. Units shown are mitigation credits.

Water Provider	Zone of Impact	Mitigation Obligation <20 years	Permanent Credits Supplied	Temporary Credits Supplied	Unassigned and Pending Credits	Mitigation Demand
City of Bend	General	3223	730.75	0	87.7	2404.55
City of La Pine	Little Deschutes River	405.2	2.1	0		403.1
City of Prineville[6]	Crooked River	1969.9	603.9	0	5100[7]	0
City of Redmond	General	1746	1746	0	532.93	0
City of Sisters	Whychus Creek	241.8	81.2	0	7.2	153.4
Avion Water Company	General	1331.8	196.37	0	234.72	900.71
Deschutes Valley Water District	General	1387.2	0	128.4		1387.2
Brasada	General	203.2	1.8	98.2		201.4
Indian Rock Homeowners Association	Crooked River	66.6	1.8	0		64.8
Pinnacle Utilities, LLC	General	1356.4	0	3.6		1356.4
Sno-Cap Homeowners Association	General	5.1	0	5.1		5.1
Sunriver Water	Upper Deschutes River	716	2.1	0		713.9
Terrebonne Domestic Water District	Crooked River	48	10.1	0		37.9
Whitefish Cascade Forest Resources	Little Deschutes River	640	562.5	0	164.1	0
Bentwood Estates Water District	General	32.2	0	32.2		32.2
Highland Subdivision Water District	General	6.2	6.2	0		0
Arrowood Community Water Co. LLC	General	27.2	27.2	0		0

Total Municipal and Quasi-municipal Mitigation Demand From Existing Permits: 7,660. 7

[6] Two points of appropriation under the City of Prineville's Permit G-17236 (Application G-16900) are in the General zone of impact, while seven points of appropriation are in the Crooked River zone of impact. Because there are no well-specific volume limits listed on the permit, there is no way to determine what portion of the mitigation obligation under Permit G-17236 will be supplied with General zone mitigation credits and Crooked River zone mitigation credits. For the purposes of this memo, the full mitigation obligation for Permit G-17236 has been treated as though it is in the Crooked River zone of impact.

[7] For the City of Prineville, unassigned and pending credits also includes 5,100 mitigation credits in the Crooked River zone of impact for stored water releases for instream use. These credits are contingent on the implementation of the Crooked River Collaborative Water Security and Jobs Act of 2014 and are not currently associated with a mitigation project.

3.1.2 Anticipated Additional Mitigation Demand

The short-term demand for mitigation also includes the projected mitigation obligation for new water rights expected to be issued over the next 20-years. To estimate this demand, GSI determined the mitigation obligations associated with the groundwater applications filed with OWRD within the Deschutes Study Area during the ten-year period from January 1, 2005 to December 31, 2014. GSI only considered those applications for which permits were issued or that remained pending as of December 31, 2015. Applications that were filed during this time period but that were denied or permits that were cancelled were excluded. GSI excluded municipal and quasi-municipal permit applications from consideration. The projected 20-year demand for Municipal and Quasi-Municipal permits is already captured in **Table 3.3**, above.

Based on the mitigation obligations for the identified applications, GSI calculated the average annual mitigation demands for each zone of impact by dividing the total required mitigation for each zone of impact by 10 (the number of years considered). GSI also calculated the average annual mitigation demands by character of use for the permits issued. The average annual mitigation demand was then multiplied by 20 to estimate the mitigation demand during the 20-year period from 2016 through 2035. Based on the large year-to-year variability in mitigation obligations for irrigation, GSI used the *median* annual mitigation demand when estimating the projected mitigation demand for irrigation use.

The demand for permanent mitigation credits from 2005 through 2014, not including applications for Municipal and Quasi-municipal use, was determined to be 80.5 credits per year. Applying this rate of demand to the next 20 years results in a total short-term projected demand of approximately 1,610 mitigation credits. (80.5 x 20 = 1610) **Table 3.4** shows this calculated annual mitigation demand and projected new demand by zone of impact. **Table 3.5** provides the annual mitigation demand and projected new demand by character of use.

Table 3.4: Annual mitigation demand (for 2005-2014) and projected 20-year mitigation demand by zone of impact, not including mitigation demand for municipal and quasi-municipal permits. (Units shown are mitigation credits.)

Zone of Impact	2005-2014 Annual Mitigation Demand	Projected 2016-2035 mitigation demand
General	44.15	883.01
Crooked River	27.39	547.77
Metolius River	1.11	22.24
Whychus Creek	0.99	19.71
Middle Deschutes	4.51	90.20
Upper Deschutes	0.87	17.43
Little Deschutes	1.46	29.18
Total:	80.48	1,609.54

Table 3.5: Annual mitigation demand (for 2005-2014) and projected 20-year mitigation demand by character of use. , not including mitigation demand for municipal and quasi-municipal permits. (Units shown are mitigation credits.)

Use	2005-2014 Annual Mitigation Demand	Projected 2016-2035 Mitigation demand
Group Domestic and Domestic	0.25	5.00
Irrigation	56.70	1134.00
Agriculture		0.00
Commercial	0.48	9.60
Storage (Including Pond Maintenance)	2.38	47.54
Industrial	19.77	395.40
Nursery	0.90	18.00
Total:	80.48	1,609.54

3.1.3 Total Short-Term Mitigation Demand

The total mitigation demand for 2016 through 2035 of 13,233.0 mitigation credits (acre-feet) was determined by summing the following projected 20-year mitigation demands described above:

1)	Pending applications and existing final orders (Table 3.1)	3,562.6
2)	Mitigation being provided by temporary credits (Table 3.2)	400.2
3)	Existing municipal and quasi-municipal demand (Table 3.3)	7,660.7
4)	Projected "new" non-municipal 20-year demand (Tables 3.4 and 3.5)	1,609.5
Total		13,233.0

Table 3.6 and **Table 3.7** show total mitigation demand for 2016 through 2035 by zone of impact and character of use, respectively.

Table 3.6: Total 20-year mitigation demand by zone of impact. (Units shown are mitigation credits.)

Zone of Impact	Projected 20-Year Mitigation Demand
General	9,657.4
Crooked River	1,811.5
Metolius River	68.8
Whychus Creek	368.8
Middle Deschutes	122.6
Upper Deschutes	738.5
Little Deschutes	465.4

Total:	13,233.0

Table 3.7: Total 20-year mitigation demand by character of use. (Units shown are mitigation credits.)

Use	Projected 20-Year Mitigation Demand
Municipal and Quasi-Municipal	10,103.3
Group Domestic and Domestic	5
Irrigation	2,606.3
Agriculture	9.78
Commercial	19.3
Storage (Including Pond Maintenance)	66.99
Industrial	395.4
Nursery	27
Total:	13,233.0

3.2 Mitigation Supply

GSI estimated the supply of permanent mitigation credits that is currently available to meet the existing mitigation demands described above. Using data provided by OWRD, GSI calculated the number of "outstanding credits," which are permanent mitigation credits generated through an instream transfer but that have not yet assigned to water rights. GSI also calculated the number of "pending credits," which are permanent mitigation credits expected to be generated through instream transfers that were pending with OWRD as of December 31, 2015. As described above, GSI is aware that some mitigation credits, although not yet assigned to a permit, are contracted for sale to quasi-municipal or municipal water service providers. Those mitigation credits were considered above as part of the municipal/quasi-municipal mitigation supply and are not considered in this analysis of available mitigation supply.

Table 3.8 shows outstanding mitigation credits for each zone of impact and **Table 3.9** shows pending mitigation credits for each zone of impact. It should be noted that credits are available in multiple zones of impacts, so the total number of mitigation credits available will not be equal to the number of credits available within each zone of impact.

GSI identified 344.6 outstanding mitigation credits and 206.6 pending mitigation credits. Taken together, the existing mitigation supply of 551.2 mitigation credits and 20-year mitigation demand of 13,233.0 credits indicate a projected need of up to 12,681.8 mitigation credits.

Table 3.8: Outstanding mitigation credits by zone of impact.

Zone of Impact	Outstanding Credits
General	320.0
Crooked River	123.7
Metolius River	-
Whychus Creek	-
Middle Deschutes River	196.3
Upper Deschutes River	81.7
Little Deschutes River	95.7
Total:	344.6

Table 3.9: Pending mitigation credits by zone of impact.

Zone of Impact	Pending Credits
General	206.6
Crooked River	64.8
Metolius River	-
Whychus Creek	120.8
Middle Deschutes River	19.5
Upper Deschutes River	-
Little Deschutes River	1.5
Total:	206.6

4. Long-term (50-year) Mitigation Demand

GSI also projected the long-term (50-year) demand for permanent mitigation under the Deschutes Basin Groundwater Mitigation Program, which is the projected demand for permanent mitigation credits required to fulfill mitigation obligations between 2036 and 2065. (This demand is in addition to the short-term demand for mitigation between 2016 and 2035.) The 2036 to 2065 demand was estimated considering two components: demand that results from population growth and increased commercial demand within the service areas of existing municipal and quasi-municipal water service providers, and new permit applications projected to be filed between 2036 and 2065. It should be acknowledged that projecting mitigation demand out to 2065 requires numerous assumptions and a certain level of estimation. Given the level of uncertainty, a more rigorous analysis is not expected to provide increased accuracy. The following is intend as a "planning level" estimate that could inform water resource scenarios being developed as part of the Basin Study.

4.1 50-Year (2036 to 2065) Projection - Municipal and Quasi-Municipal Water Service Providers

GSI estimated the 2065 mitigation demand for municipal and quasi-municipal water providers, by projecting the future water demands within the service areas of three of the five municipal water providers. Demand based on population growth within the Redmond and Prineville urban growth boundaries (UGBs) was not considered based on the understanding that these cities will have sufficient mitigation to meet their needs during the next 50 years. Additionally, this analysis did not consider which municipal or quasi-municipal water provider would serve the new customers, but only evaluated the growth and demand within the three UGBs.

The 2065 mitigation demand was estimated by obtaining population growth projections[8] and then applying a per-capita demand to the increased populations. GSI considered the projected population growth anticipated from 2036 to 2065 within the service areas of the cities of Bend[9], Sisters and La Pine. **Table 4.1** shows the projected population growth from 2035 to 2065 within the three UGBs.

Table 4.1: Projected population growth for three cities' UGBs.

Location	2035 population	2065 population	Population growth (2035-2065)
Bend UGB	132,209	194,793	62,584
Sisters UGB	4,375	7,212	2,837
La Pine UGB	3,014	5,836	2,822

GSI next estimated the water demands associated with the above-described population growth between 2035 and 2065 within the three cities' UGBs. Projections are based on two demand scenarios: 200 gallons per-capita per-day (gpcd) and 300 gpcd to provide a range of potential demand.[10] (To clarify, the per-capita water demand calculations are intended to reflect increased demand by population growth and increased commercial, industrial, and other water uses from 2036 to 2065, and does not reflect the anticipated volume of water used by an individual person during the peak-demand season.)

GSI next determined the amount of mitigation that would be required to meet the projected growth in demand between 2035 and 2065. In developing these demand projections, GSI assumed that mitigation would only be required for additional water use during a 180-day period of use annually and that mitigation will be based on 50 percent consumptive use. **Table 4.2** shows projected additional mitigation demand for the three cities' UGBs under the two per capita demand scenarios.[11]

---

[8] Population projections were obtained from: Ruan, Xiaomin, R. Proehl, J. Jurjevich, K. Rancik, J. Kessi, C. Gorecki, and D. Tetrick, "Coordinated Population Forecast for Deschutes County, its Urban Growth Boundaries (UGB), and Area Outside UGBs 2015-2065. Portland State University Population Research Center, June 2015.

[9] The Bend area is served by four water service providers. As previously described, this evaluation did not consider how (via which provider) the new population is supplied. The projection assumes that all additional demand will require mitigation credits.

[10] Using per capita demands of 200-300 gpcd is conservative. According to an OWRD study (Oregon Water Resources Department 2015. Statewide Long-Term Water Demand Forecast: Oregon's Integrated Water Resources Strategy) Bend's annual gpcd is 207. In contrast, these projections for mitigation demand are based on an assumption that mitigation would be required for 180 days during the period of peak demand, and per capita demand during the peak season is higher than the annual per capita demand.

[11] For each entity, the population growth figure was multiplied by the per capita demand (200 gpcd and 300 gpcd), multiplied by 180 days, converted to acre-feet, and finally multiplied by 0.5 (the consumptive use coefficient).

Table 4.2: Projected mitigation demand for Upper Deschutes basin UGBs, 2036-2065.

Location	Municipal Long-Term Mitigation Demand (2036 – 2065)	
	200 gpcd Demand Scenario (AF)	300 gpcd Demand Scenario (AF)
Bend UGB	3,457.14	5,185.71
Sisters UGB	156.72	235.07
La Pine UGB	155.89	233.83
Total:	3,769.74	5,654.62

Population growth outside of UGBs was not considered except in the case of Terrebonne Water District, whose incremental mitigation plan includes increments of development beginning after 2035. Terrebonne's incremental mitigation plan projects that 96.8 mitigation credits will be supplied to two increments that begin after 2035. Adding this demand to the above described projections yields a potential 2036 to 2065 demand for mitigation ranging from approximately 3,866 to 5,751 credits, as shown in **Table 4.3**.

Table 4.3: Projected municipal and quasi-municipal mitigation demand, 2036-2065.

Use	Long-Term Mitigation Demand (2036 – 2065)	
	200 gpcd Municipal Demand Scenario (AF)	300 gpcd Municipal Demand Scenario (AF)
Municipal	3,769.74	5,654.62
Quasi-Municipal (Terrebonne Water District)	96.8	96.8
Total:	3,866.54	5,751.42

4.2 50-Year projection (2036 to 2065) - Mitigation Demand for New Permit Applications

Using the same methodology used for estimating "new" 20-year demand for mitigation, GSI projected the demand for mitigation associated with new groundwater permit applications expected to be issued by OWRD from 2036 through 2065. Of course, this approach assumes the mitigation program sunset will be extended beyond 2029.

GSI based this projection on the average annual mitigation demand[12] associated with applications filed during the ten-year period from January 1, 2005 to December 31, 2014.[13] The annual mitigation

[12] As previously described, this methodology used the median annual mitigation demand for irrigation use for 2005-2014, and the mean annual mitigation demand for all other uses. (The median was used for irrigation because there was large year-to-year variability in mitigation obligation for irrigation, which caused the mean annual mitigation demand for irrigation to be very high.)

[13] GSI only considered those applications for which permits were issued or that remained pending as of December 31, 2015. Applications that were filed during this time period but that were denied or permits that were cancelled were excluded.

demand for each beneficial use (or zone of impact) was multiplied by 30 to project the anticipated additional mitigation demand that will be created during the 30-year period from 2036 through 2065. As before, this methodology was used to estimate mitigation required for all new beneficial uses except for municipal and quasi-municipal water supply, which was estimated as described above.

Table 4.4 shows projected new applications from 2036 to 2065 by zone of impact. **Table 4.5** shows the same projections by character of use.

Table 4.4: Annual 2005-2014 mitigation demand and projected 2036-2065 mitigation demand by zone of impact, not including mitigation demand for municipal and quasi-municipal permits. (Units shown are mitigation credits.)

Zone of Impact	2005-2014 Annual Mitigation Demand	Projected 2036-2065 Mitigation Demand
General	44.15	1324.51
Crooked River	27.39	821.65
Metolius River	1.11	33.35
Whychus Creek	0.99	29.57
Middle Deschutes	4.51	135.30
Upper Deschutes	0.87	26.15
Little Deschutes	1.46	43.78
Total:	80.48	2,414.31

Table 4.5: Annual 2005-2014 mitigation demand and projected 2036-2065 mitigation demand by character of use, not including mitigation demand for municipal and quasi-municipal permits (Units shown are mitigation credits.)

Use	2005-2014 Annual Mitigation Demand	Projected 2036-2065 Mitigation demand
Group Domestic and Domestic	0.25	7.50
Irrigation	56.70	1,701.00
Agriculture	-	-
Commercial	0.48	14.40
Storage (Including Pond Maintenance)	2.38	71.31
Industrial	19.77	593.10
Nursery	0.90	27.00
Total:	80.48	2,414.31

4.3 Total Long-Term Mitigation Demand

The total mitigation demand for 2036 through 2065 of 6,280.9 to 8,165.73 credits, depending on whether new municipal and quasi-municipal use was projected using a 200 gpcd or a 300 gpcd scenario, was determined by summing the following projected 2036 through 2065 mitigation demands described above:

1) Projected municipal and quasi-municipal mitigation demand, 2036-2065 (Table 4.3) 3,866.54 – 5,751.42

2) 2036-2065 Mitigation Demand for new permit applications, not including municipal and quasi-municipal use (Table 4.4 and 4.5) 2,414.31

Total **6,280.9 – 8.165.73**

Table 4.6 and **Table 4.7** show projected 2036 through 2065 mitigation demands by character of use and zone of impact, respectively.

Table 4.6: Long-term mitigation demand by character of use. (Units shown are mitigation credits.)

Use	Projected 2036-2065 Mitigation Demand	
	Municipal at 200 gpcd	Municipal at 300 gpcd
Municipal and Quasi-Municipal	3,866.5	5,751.4
Group Domestic and Domestic	7.5	7.5
Irrigation	1701	1701.0
Agriculture	0	0.0
Commercial	14.4	14.4
Storage (Including Pond Maintenance)	71.3	71.3
Industrial	593.1	593.1
Nursery	27	27.0
Total:	**6,280.9**	**8,165.7**

Table 4.7: Long-term mitigation demand by zone of impact. (Units shown are mitigation credits.)

Zone of Impact	Projected 2036-2065 Mitigation Demand	
	Municipal at 200 gpcd	Municipal at 300 gpcd
General	4781.7	6510.2
Crooked River	918.5	918.5
Metolius River	33.4	33.4
Whychus Creek	186.3	264.6
Middle Deschutes	135.3	135.3
Upper Deschutes	26.1	26.1
Little Deschutes	199.7	277.6
Total:	**6,280.9**	**8,165.7**

Therefore, the total permanent mitigation demand through 2065 is projected to be between 19,513.9 and 21,398.8 credits. The total mitigation demand was determined by summing the 20-year projection (see **Table 3.6** and **Table 3.7**) and the 2036-2065 projection (see **Table 4.6** and **Table 4.7**).

After considering the 50-year demand for mitigation and permanent mitigation supply (see **Table 3.8** and **Table 3.9**), there is a projected need for approximately 18,962.7 – 20,847.6 permanent mitigation credits.

5. Estimated Consumptive Use for Water Rights with the 7(j) Condition

5.1 Background

In addition to estimating the 20 and 50-year projected demand for mitigation credits, GSI documented information about the status and estimated consumptive use of water rights containing the "7(j) condition." Groundwater rights issued in the Deschutes Basin after the enactment of Senate Bill 1033 (1995), but prior to 1998 when initial data from the Deschutes Basin Groundwater Study became available, include this permit condition and are often referred to as "7(j) water rights." The 7(j) condition, also referred to as the "Scenic Waterway Condition," reads:

> Use of water under authority of this permit may be regulated if analysis of data available after the permit is issued discloses that the appropriation will measurably reduce surface water flows necessary to maintain the free-flowing character of scenic waterways in the quantities necessary for recreation, fish, and wildlife in effect as of the priority date of the right or as those quantities may be subsequently reduced.

In the event that mitigation was needed for the 7j water rights, the amount of mitigation would likely be commensurate with the estimated consumptive use.[14]

5.2 Status of 7(j) rights

Based on information provided by OWRD and the Deschutes River Conservancy (DRC), it was determined that there are currently 159 of the original "7(j) water rights. The total authorized rate of the 159 7(j) water rights was calculated to be 127.72 cfs.[15]

5.3 Consumptive Use of 7(j) rights

GSI estimated the consumptive use for the majority of the 159 7(j) water rights. (Consumptive use was not estimated for uses such as fish and wildlife, pollution abatement, pond maintenance, etc.) This estimation is based on the same assumptions typically used by OWRD to calculate the mitigation obligation for new permits issued in the Deschutes Groundwater Study Area. As shown in **Table 5.1** GSI estimated a total combined consumptive use of 24,357 acre-feet for the 7(j) water rights.

---

[14] This information is being provided for reference, however, we are not aware of any plans for OWRD to require mitigation for these permits

[15] Due to the format of aggregated water rights data, it's possible to double count rates for water rights with multiple points of appropriation and/or multiple approved uses. The rate for each water right was compared to the calculated rates from a previous effort undertaken by Deschutes River Conservancy (DRC) staff. Discrepancies were resolved through review of water right documents including water right permits, certificates, transfers, and permit amendments.

Table 5.1: Estimated consumptive use for 7(j) conditioned water rights.

Category of Use	Estimated Consumptive Use (AF)	Assumptions
Primary Irrigation	11,916	Consumptive Use = 1.8 AF/acre
Supplemental Irrigation	4,634	Consumptive Use = 1.8 AF/acre
Municipal	714	Consumptive Use = Maximum rate used 24/7 for 180 days mitigating at 40% consumptive use.
Quasi-municipal	6,956	Consumptive Use = Maximum rate used 24/7 for 180 days mitigating at 40% consumptive use.
Domestic	137	Consumptive Use = Maximum rate used 24/7 for 180 days mitigating at 20% consumptive use.
Total:	24,357	

6. Exempt Uses

As described in ORS 537.545, some groundwater appropriations are exempt from the requirement to obtain a water right. The most common exempt groundwater uses include:

- Single or group domestic purposes in an amount not exceeding 15,000 gallons per day
- Any single industrial or commercial purpose in an amount not exceeding 5,000 gallons per day
- Watering of a lawn or noncommercial garden not exceeding one-half acre
- Stock watering
- Down-hole heat exchange purposes

OWRD provided information estimating the consumptive use of groundwater in the Deschutes Basin under the exempt use provisions. Similar to the 7(j) water rights, in the event that mitigation was needed for exempt uses of groundwater, it is plausible that the amount of mitigation would likely be commensurate with the estimated consumptive use.[16]

OWRD first estimated the number of wells in the basin, based on the number of well logs for new wells. (Well logs for well deepening, abandonment, monitoring wells and geotechnical wells were excluded.) This approach yielded an estimate of 21,337 wells in the basin.

To estimate the consumptive use under the exempt groundwater uses in the Deschutes Study Area, OWRD assumed that all of the 21,337 wells were used for exempt domestic use (at 300 gallons per day (gpd)) and commercial use (at 100 gpd). OWRD also assumed that 20 percent of the wells were used for irrigation of one-half acre. **Table 6.1** shows OWRD's assumptions and the resulting estimated consumptive uses. OWRD's methodology results in a total estimated consumptive use of "exempt" groundwater of 5,036 acre-feet.

[16] Similar to the 7(j) water rights, this information is being provided as a reference. We are not aware of any plans for OWRD to require mitigation. Further, the agency has indicated that it does not have legal authority for such a requirement.

Table 6.1: Annual consumptive use of groundwater under exempt use provisions

Exempt Use	Percent Consumptive	Assumptions	Annual Consumptive Use (AF)
Domestic Use	10%	All wells use 300 gallons/day	717
Commercial Use	20%	All wells use 100 gallons/day	478
Irrigation of 1/2 acres	0.9 AF (1/2 acre at 1.8 AF/acre)	20% of wells irrigate 1/2 acre	3841
		Total:	5,036

7. Options for Establishing Groundwater Mitigation Supplies

OWRD's Deschutes Basin Ground Water Mitigation rules authorize multiple opportunities to obtain permanent mitigation credits. The majority of the permanent mitigation credits are obtained by transferring all or a portion of an irrigation water right instream. (One credit can be generated for each acre-foot of water transferred instream.) As described in the memorandum for Task 2 (Water Right, Legal and Policy Opportunities and Impediments for Stored Water, Forbearance, Instream Flow Protection, and Mitigation), other opportunities may exist to obtain permanent mitigation credits. For example, a storage water right may be able to be transferred instream. While some potential opportunities to establish mitigation credits may, alone, raise some concerns, there may be opportunities to combine multiple water right activities into a package that, taken as a whole, would alleviate concerns and could results in the establishment of permanent mitigation credits.

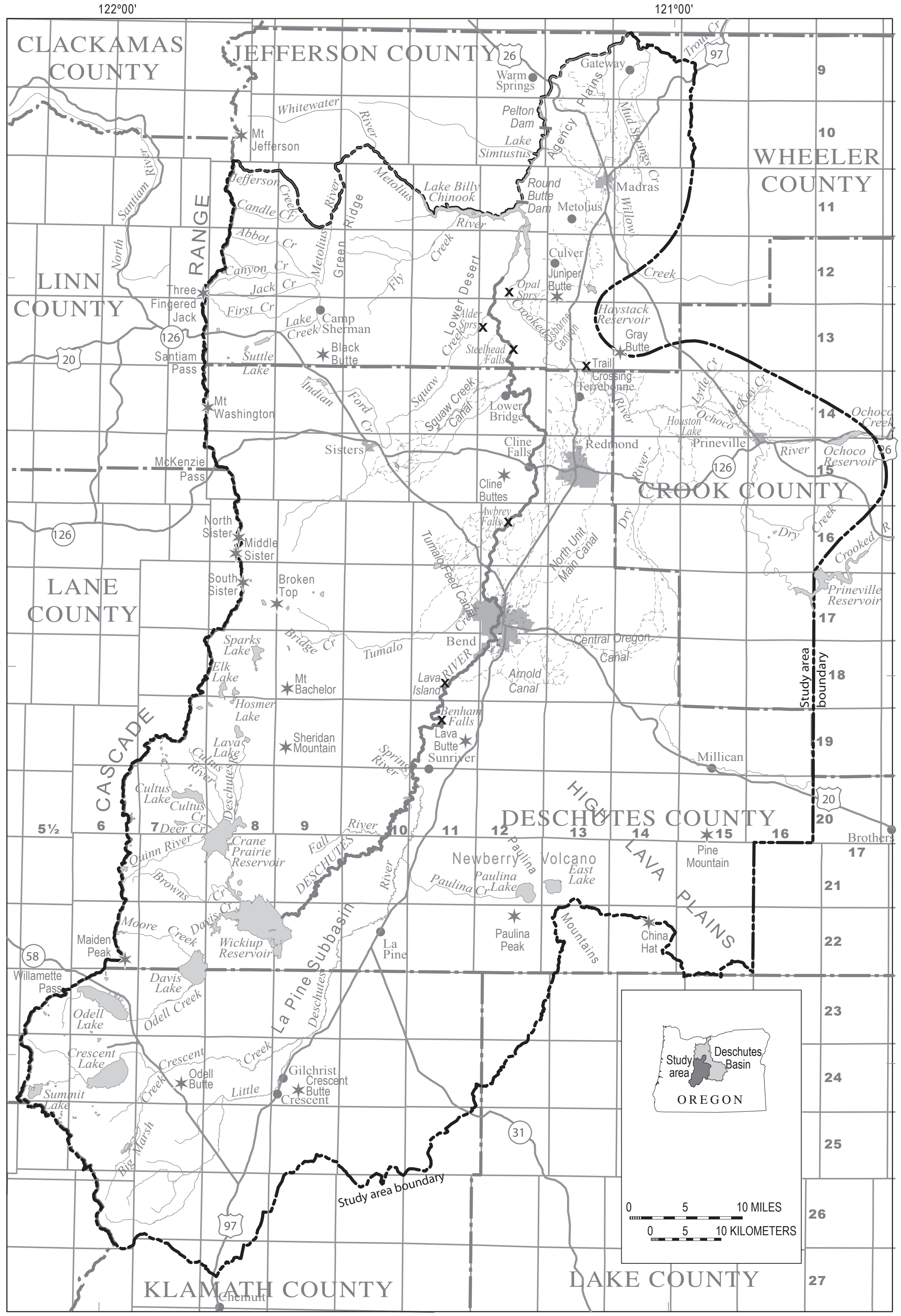
8. Summary

GSI evaluated the projected supply of, and demand for, mitigation under the Deschutes Basin Groundwater Mitigation Program. The estimated demand for permanent mitigation credits were evaluated in two components: demand during the next 20 years; and the demand from 2036 through 2065 (the 50-year demand). The 20-year demand included two components. First, it considered existing permits for which *permanent* credits had not yet been provided. Second, GSI estimated the mitigation that would be required for permits that would be issued during the next 20 years. To develop the 50-year demand projection for permanent mitigation credits, GSI considered the demands associated with new water rights expected to be issued from 2036 through 2065. This projection included new municipal water rights to meet demands within the urban growth boundaries for the cities of Bend, Sisters and La Pine, and mitigation required by new groundwater rights issued for uses other than municipal/quasi-municipal supply.

GSI also developed an estimate of the permanent mitigation supply expected to be available to meet the future demands for mitigation. The estimate was based on data from OWRD about existing unused credits and pending instream water right transfers that are expected to generate mitigation credits.

The difference between the estimated permanent mitigation supply and the projected 20-year and 50-year demands were calculated. The results are the projected future need for permanent mitigation credits during those time periods.

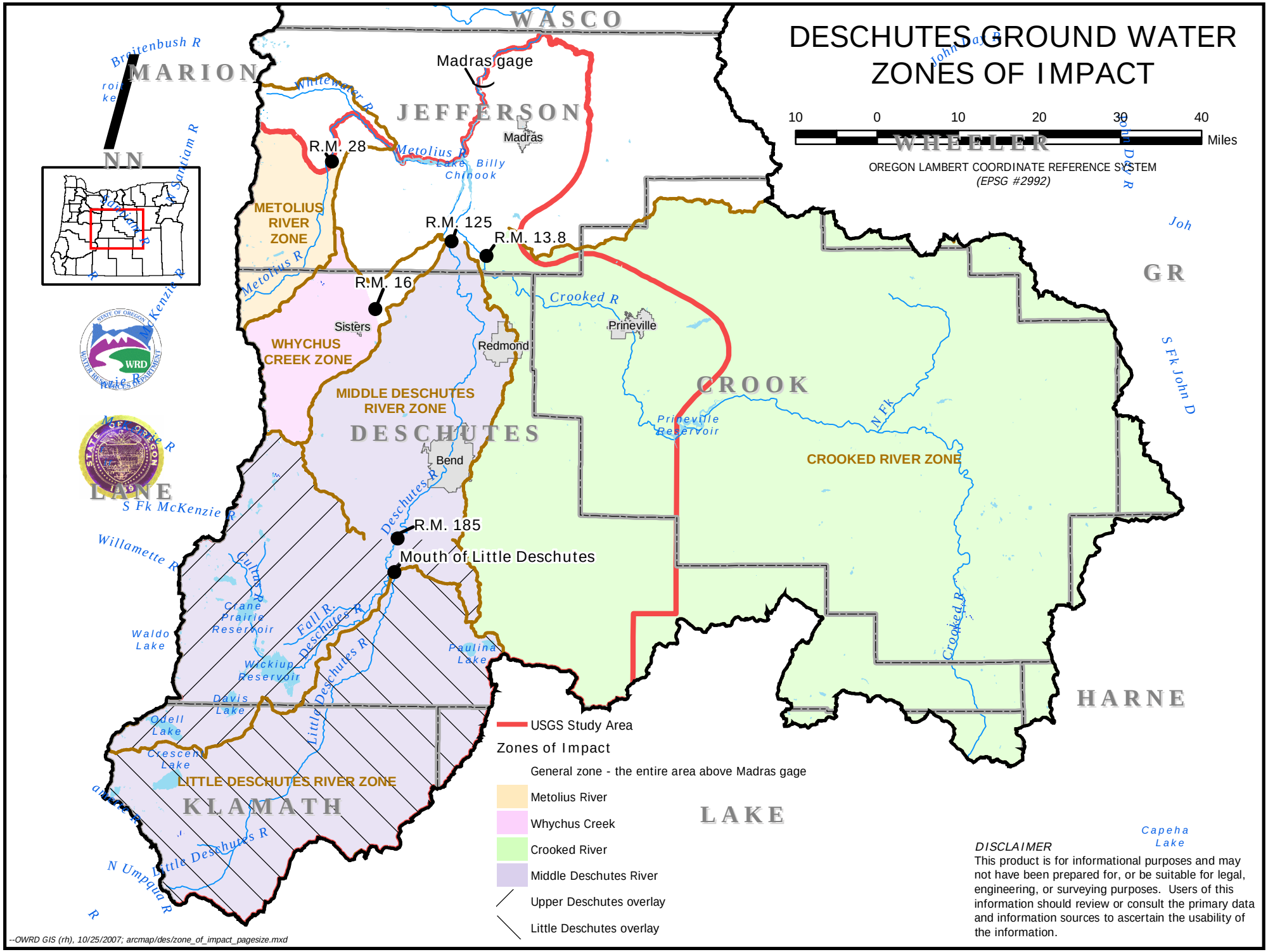
Figure 1
Deschutes Groundwater Study Area



122°00'
121°00'
44°30'
44°00'
43°30'
CLACKAMAS COUNTY
JEFFERSON COUNTY
WHEELER COUNTY
LINN COUNTY
CROOK COUNTY
LANE COUNTY
DESCHUTES COUNTY
KLAMATH COUNTY
LAKE COUNTY
CASCADE
RANGE
HIGH LAVA PLAINS
Warm Springs
Gateway
Pelton Dam
Lake Simtustus
Mt Jefferson
Madras
Metolius
Round Butte Dam
Lake Billy Chinook
Culver
Juniper Butte
Haystack Reservoir
Gray Butte
Trail Crossing
Terrebonne
Three Fingered Jack
Camp Sherman
Black Butte
Santiam Pass
Mt Washington
Sisters
Lower Bridge
Cline Falls
Redmond
Prineville
Ochoco Reservoir
Cline Buttes
McKenzie Pass
North Sister
Middle Sister
South Sister
Broken Top
Bend
Prineville Reservoir
Sparks Lake
Elk Lake
Mt Bachelor
Lava Island
Benham Falls
Lava Butte
Sunriver
Hosmer Lake
Lava Lake
Sheridan Mountain
Millican
Cultus Lake
Crane Prairie Reservoir
Newberry Volcano
Paulina Lake
East Lake
Pine Mountain
Brothers
Wickiup Reservoir
Paulina Peak
China Hat
Maiden Peak
La Pine
Willamette Pass
Davis Lake
Odell Lake
Crescent Lake
Odell Butte
Gilchrist
Crescent Butte
Crescent
Summit Lake
Chemult
La Pine Subbasin
Study area boundary
North Unit Main Canal
Central Oregon Canal
Arnold Canal
Tumalo Feed Canal
Squaw Creek Canal
Deschutes River
Crooked River
Metolius River
Whitewater River
Ochoco Creek
Paulina Mountains
20
26
97
126
58
31
0 5 10 MILES
0 5 10 KILOMETERS
Study area
Deschutes Basin
OREGON

Figure 2

Deschutes Basin Groundwater Mitigation Program Zones of Impact


DESCHUTES GROUND WATER ZONES OF IMPACT
10 0 10 20 30 40
Miles
OREGON LAMBERT COORDINATE REFERENCE SYSTEM
(EPSG #2992)
WASCO
MARION
JEFFERSON
WHEELER
GR
CROOK
DESCHUTES
LANE
KLAMATH
LAKE
HARNE
Madras gage
Madras
R.M. 28
R.M. 125
R.M. 13.8
R.M. 16
R.M. 185
Mouth of Little Deschutes
Sisters
Redmond
Prineville
Bend
METOLIUS RIVER ZONE
WHYCHUS CREEK ZONE
MIDDLE DESCHUTES RIVER ZONE
CROOKED RIVER ZONE
LITTLE DESCHUTES RIVER ZONE
Metolius R
Whitewater R
Lake Billy Chinook
Crooked R
Prineville Reservoir
N Fk
S Fk John D
John Day R
Deschutes R
Little Deschutes R
Fall R
Crane Prairie Reservoir
Wickiup Reservoir
Davis Lake
Odell Lake
Crescent Lake
Waldo Lake
Paulina Lake
Cultus R
Willamette R
S Fk McKenzie R
N Umpqua R
Capeha Lake
USGS Study Area
Zones of Impact
General zone - the entire area above Madras gage
Metolius River
Whychus Creek
Crooked River
Middle Deschutes River
Upper Deschutes overlay
Little Deschutes overlay
DISCLAIMER
This product is for informational purposes and may not have been prepared for, or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information.
--OWRD GIS (rh), 10/25/2007; arcmap/des/zone_of_impact_pagesize.mxd