

MEMORANDUM



MWH
MONTGOMERY WATSON HARZA

TECHNICAL MEMORANDUM: TUALATIN RIVER WATER DEMAND PROJECTIONS

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WATER DEMAND PROJECTIONS

There are three principal components of water demand in the Tualatin Basin. These are: 1) instream flow restoration, 2) irrigated agriculture, and 3) municipal and industrial (M&I) supply. This section discusses these demand components, and estimates peak season water requirements to the year 2050. Peak season refers to the drier, warmer summer and fall months when water demand is typically highest. Each demand sector defines peak season slightly differently. Peak season is defined for each sector below.

WATER DEMAND PROJECTIONS FOR INSTREAM FLOW RESTORATION

The Tualatin River is 83 miles long and has a nearly flat gradient for most of its length. The slow moving character of the river poses significant water quality and quantity challenges, especially during the summer months when the flow is at its lowest. These challenges have grown in complexity as population growth has increased, bringing about the need for a holistic management approach that focuses on the needs of the entire watershed.

Prior to European settlement, the river and its tributaries may have had higher flows during the summer months than they do today. Recent changes on flow patterns are the result of urbanization and agricultural and forest practices. Among the specific causes of flow changes are the construction of impervious surfaces, the removal of beaver dams, woody debris and other impediments to river flow, the filling of wetlands, the removal of trees, and irrigation withdrawals.

Because lost river flow causes many environmental problems, including higher pollution levels and reduced species habitat, the management of the Tualatin River has included river flow restoration since the 1970's.

ELEMENTS OF DEMAND

1. PHOSPHORUS AND AMMONIA NITROGEN

Clean Water Services (CWS) (formerly, "The Unified Sewerage Agency,"), was created in 1970 in order to consolidate wastewater treatment operations in the urban portion of the Tualatin River Basin. At that time there were 28 poorly functioning wastewater treatment plants and the river had high levels of pollutants such as ammonia-nitrogen, phosphorus and bacteria. During the 1970's, CWS consolidated sewage treatment operations by shutting down many plants and constructing two large, state-of-the-art facilities. In addition, following the construction of Scoggins Dam in 1975, CWS began purchasing Hagg Lake water from the U.S. Bureau of Reclamation to restore the flow of the Tualatin River during the summer months. Flow restoration helped reduce algal blooms and water temperature by increasing the flow velocity of the river when its flow would otherwise be nearly stagnant.

Although water quality in the river improved as a result of CWS's actions, algal blooms, low dissolved oxygen concentrations, and toxic levels of ammonia-nitrogen continued to be a problem.

Following a lawsuit by the Northwest Environmental Defense Center against the Oregon Department of Environmental Quality, in 1988 the Tualatin River became one of the first water bodies in the nation for which Total Maximum Daily Loads (TMDL's) were established. At that time the TMDL's, a Clean Water Act requirement, applied to ammonia nitrogen and phosphorus.

After the TMDL's were created, CWS's Environmental Protection Agency (EPA) permits required that CWS continue to restore river flow with Hagg Lake water. Under the permits, the primary purpose of restoration was to dilute sewage treatment plant effluent, which initially contained higher levels of ammonia nitrogen and phosphorus than were found in the river. After a series of treatment plant upgrades, however, the effluent contained far lower levels of these nutrients. As a result, beginning in 1992 CWS's permits no longer required flow restoration. CWS continued its flow restoration program, however, because of its water quality benefits.

The numerous treatment plant upgrades that occurred during the 1980's and 1990's largely eliminated the ammonia nitrogen problem. River phosphorus levels continued to exceed target levels however. Further improvement would depend largely on reductions in the phosphorus levels of non-point sources. Efforts to control phosphorus levels in non-point sources have been made in each of the three main contributor categories: forestry, agriculture and urban development. These include the Oregon Forest Practices Act (public and private forest lands), Senate Bill 1010 (Agriculture), and EPA's Municipal Separate Storm Sewer System (MS4) permit (urban), which has been held jointly by CWS and Washington County since 1991. In addition, CWS has issued standards for new development that require setbacks from streams and regulate the design of storm water facilities.

Despite increased regulation and the continued use of flow restoration, phosphorus levels within the river continued to exceed the target. This was due in part to the fact that there was much urban development that pre-dated the CWS design and construction standards. In addition, and more importantly, during the 1990's it was discovered that background levels of phosphorus in Tualatin Basin groundwater were quite high, making it virtually impossible to meet target levels. Nevertheless, phosphorus levels in flow restoration water are considerably below the levels in urban non-point source runoff, making flow restoration a significant tool in managing river phosphorus levels.

2. NEW TMDL'S

DEQ recently developed new TMDL's for the river and its tributaries. The TMDL's apply to phosphorus, temperature, bacteria and dissolved oxygen. They have not yet been added to CWS's EPA wastewater and storm water permits; nor have TMDL implementation plans been developed.

It is anticipated that flow restoration will be a significant tool in the TMDL compliance effort. In addition to reducing river phosphorus levels, flow restoration can be used to lower temperature and bacteria levels, and increase dissolved oxygen. Oxygen provides an instructive example of how flow restoration improves water quality. Low river flow during the summer months can cause an explosive growth in the algae population. When the algae dies, oxygen-consuming microbes decompose it. Restored river flow helps to rid the river of algae and prevent water temperature increases that encourage algae growth. With less algae to consume, the microbes consume less oxygen.

3. ENDANGERED SPECIES ACT

In 1999, the Upper Willamette River spring chinook and Upper Willamette River winter steelhead were listed as threatened species under the federal Endangered Species Act (ESA). The river and its tributaries have been designated as critical habitat, which means that the ESA's protections extend to these areas. In response, ten local government agencies in the Tualatin River Watershed agreed to prepare the Healthy Streams Plan (HSP), which is currently undergoing development. CWS is the lead agency in this effort.

The HSP will focus on compliance with the ESA under either Section 4(d) or Section 10 of the ESA. The HSP will also address compliance with the Clean Water Act. Because of recent litigation and possible regulatory changes, the future of the chinook and steelhead listings is unclear. Nevertheless, it is anticipated that the HSP will include flow restoration as a major element. Flow restoration helps fish species by enhancing fish habitat and assisting in fish passage. When river flow is too low, fish may become trapped in areas that lack sufficient resources to sustain fish populations, or may be prevented from accessing areas that do have such resources. Flow restoration also helps improve water quality, as noted above.

4. LOW-WATER YEARS

In the 1990's, the U.S. Geological Survey (USGS) developed water quality and temperature models for the Tualatin River. The models have been used in developing flow targets for the river. The current minimum dry season flow targets for the Farmington Bridge monitoring station are 120 cubic feet per second (cfs) during June and July and 180 cfs from August to November, which results in an average minimum dry season flow of 150 cfs. There is currently adequate water storage in Hagg Lake to meet the flow targets during a normal year. During low-water years, however, there is an inadequate supply of stored water to meet the targets. During 1992, for example, an additional 12,500 acre-feet (AF) of stored water would have been needed to meet the targets.

5. TRIBUTARIES

The current flow restoration regime is limited to the river mainstem. It does not include the tributaries, other than Scoggins Creek, which lies between Hagg Lake and the river and functions as a conduit for released water. Tributaries can provide valuable fish spawning and rearing habitat and are subject to TMDL's of their own. As noted in a related technical memo (*Water Quality - Agricultural Demand*), withdrawals for agricultural irrigation commonly reduce flow in some tributaries below the minimum set by the State. In addition, impervious surfaces associated with urban development disrupt normal runoff and groundwater recharge patterns, resulting in less water available to tributaries during the dry months. Future management decisions may include making flow restoration water available to tributaries.

6. FUTURE DEMAND

The current minimum flow targets are the result of a compromise between the amount of water desired for water quality improvement and the amount available for release. The latter is approximately 15,000 AF on an annual basis. As noted above, this amount is not sufficient to meet the flow targets during low-water years. It would also be inadequate to meet the needs of the tributaries should a decision be made to restore tributary flow. On the other hand, USGS modeling studies indicate that significant increases in flow restoration levels would improve water quality (USGS, 2001). Such improvements may be needed for compliance with the new TMDL's and the ESA. While minor increases may occur as a result of population growth (sewage treatment plant effluent), significant increases would need to come from either additional water storage or a new water supply source.

The USGS modeling efforts indicate that a minimum average dry season river flow of 300 cfs would enable the river to meet the DEQ dissolved oxygen standard of 6.5 milligrams per liter (mg/l) even if no other changes in watershed management occurred. An increase in flow of this magnitude would not be without significant problems however. It would require an enormous new water source, on the order of 68,000 AF, which is larger than the entire current storage capacity of Hagg Lake. It would also cause flooding in some areas, and may flush zooplankton and other beneficial organisms from the river, resulting in food scarcity for native species.

A more realistic approach would be to obtain an additional 15,000 AF of flow restoration water which would achieve a minimum average dry season flow at 163 cfs. With this approach, a minimum flow level that would improve water quality and fish habitat could be maintained during low-water years and in most years a modest water surplus would be available for the following year if needed.

AGRICULTURAL IRRIGATION DEMAND

The Tualatin River watershed has 75,000 acres of irrigable agricultural land, of which 27,500 acres are currently irrigated. The sources of irrigation water are groundwater, natural flow from the Tualatin River and its tributaries, and stored water from Hagg Lake. Major irrigated crop varieties include berries, silage corn, vegetables, clover and nursery stock. The average farm size is 40 acres. The largest farms are approximately 250 acres. The demand for irrigation water has stabilized in recent years.

TUALATIN VALLEY IRRIGATION DISTRICT USE

The Tualatin Valley Irrigation District (TVID) was formed on December 18, 1962, so that dry land and land with an inadequate water supply could be brought into full production. A five-member board of directors elected by district members is responsible for establishing policies and procedures and for levying annual assessments. A manager hired by the board of directors oversees day-to-day operations.

Irrigation water service is provided through a contract between TVID and the U.S. Bureau of Reclamation. Of the 34,000 irrigable acres within the TVID service area, 17,000 acres are eligible to receive water in any year. Of this amount, approximately 12,000 acres receive water through the TVID pipeline and approximately 5,000 acres are irrigated with water pumped directly from the Tualatin River or its tributaries. The Spring Hill and Patton Valley pumping facilities serve separate TVID pipelines. The Patton Valley pumping plant is located on Scoggins Creek and transports irrigation water to the Tualatin River above the mouth of Scoggins Creek. The Springhill Pumping Plant is located on the Tualatin River below Scoggins Creek. Scoggins Creek receives the outlet water from Hagg Lake.

TVID's annual water allotment is 37,000 AF, of which 27,000 AF is stored in Hagg Lake. The rest comes from river and tributary flow, as well as return flow from irrigation. The typical irrigation season is 150 days, from May 1 to September 30.

TVID levies annual assessments on its members each year. Members are required to advise TVID of the location and amount of acreage they will irrigate and their anticipated water needs. Because of market fluctuations and the need to rotate crops and idle lands for soil building, not all of the assessed lands are irrigated each year. Usually, 14,000-15,000 acres of assessed lands are irrigated, leaving a residual of 2,000-3,000 acres that can be provided water under interruptible contracts. Land must be within the TVID service area to be eligible for an interruptible contract. Not all contract usage is agricultural. Municipal and industrial (M&I) contract users include the Pumpkin Ridge Golf Course, which can use up to 362.5 AF on 145 acres, and the Reserve Vineyards and Golf Course, which can use up to 552.5 AF on 221 acres. Golf course usage is subordinate to agricultural usage.

Table 2-1 shows TVID member acreage by service area. While the table shows a total of 19,235 acres, only 17,000 acres can be irrigated each year with Scoggins project water. Also shown is the assessed acreage that uses recycled wastewater from the Clean Water Services wastewater treatment facilities.

The rate structure for TVID water is designed to encourage water conservation. The minimum charge, which pays TVID's operations and maintenance costs, entitles the water user to one AF per acre. Charges for *additional* amounts are as follows:

- first 1/2 AF: 100 percent of the minimum AF rate.
- second 1/2 AF: 120 percent of the minimum AF rate.
- third 1/2 AF: 200 percent of the minimum AF rate.

The maximum quantity of water a user can purchase is 2.5 AF per acre. Water is metered at each farm turnout and river pumping station.

Table 2-1. Tualatin Valley Irrigation District Total Assessed Acres	
Water Service Area	Assessed Acres
1. Patton Valley Pumping Plant	
a. From Pipeline	355.6
b. Within Wapato Improvement District	1,497.7
Total	1,853.3
2. Spring Hill Pumping Plant	
a. From Pipeline	10,021.7
b. From Booster Pump off West 1B Line	101.5
Total	10,123.2
3. River/Tributary Withdrawal	
a. Scoggins Creek and Tualatin River upstream of RM 60.0	832.4
b. Tualatin River, RM 60.0 to 58.8 (Dilley gauging station)	379.3
c. Tualatin River, RM 58.8 to 36.3 (Farmington gauging station)	2,390.5
d. Tualatin River, RM 36.3 to mouth	1,378.5
e. Gales Creek	277.4
Total	5,258.1
Subtotal	17,234.6
4. Wastewater Effluent	2,001.8
Total Tualatin Valley Irrigation District	19,236.4

Assessments vary by service area, reflecting whether the user is receiving water under pressure, such as that provided through the Spring Hill Pumping Plant, or gravity, where the user provides the pressure. Charges to agricultural users under interruptible contracts are generally twice those charged to member users. Charges to golf courses are the highest of all and are the same as the M&I rate.

NON-TVID AGRICULTURAL USE

Approximately 10,500 acres of Tualatin Valley irrigated agricultural land is not served by TVID. This land is located both inside and outside of the TVID service boundaries, and is irrigated with

water from the Tualatin River and its tributaries through the exercise of water rights. In the Integrated Water Resources Management Strategy (Water Managers Group, 1998), it was estimated that non-TVID land receives approximately 10,500 AF of water during a normal year.

Oregon, like most western states, is a "prior appropriation" state with respect to its water rights laws. Under this approach, each water rights holder is given a priority date that corresponds with the date when the water rights were created. In years when there is a water shortage, the right to use water is determined according to priority date: earlier priority dates take precedence over subsequent priority dates.

The Oregon Water Resources Department (OWRD) regulates the use of water rights. Within each river basin, the watermaster, a OWRD employee, monitors water supplies and, when a shortage occurs, has the authority to order water rights holders with relatively recent priority dates to stop using water. For example, during the summer of 1992, non-TVID irrigators who were ordered to stop withdrawing water from streams had priority dates that ranged from 1945 to 1976, depending on the stream and the date when the order was issued. Irrigators with older priority dates were free to continue to withdraw water. Although 1992 was a low water year, even during normal years stop orders are common. During 1999, the priority dates for users who were told to stop using water ranged from 1912 to 1976.

The smaller tributaries experience chronic water shortages due to irrigation withdrawals and other causes. On these streams there are numerous in-stream ponds that complicate water management. While these ponds contribute to the amount of water available to adjacent property owners, they can also cause water shortages for downstream users.

CONSERVATION

There does not appear to be a significant opportunity to meet future irrigation water needs through conservation. Virtually all irrigation water is conveyed by closed pipeline from the point of diversion to the point of use, so system losses due to evaporation or leakage are minimal. Approximately 99 percent of users have sprinkler irrigation systems. The remainder use drip systems, which are more efficient. Drip systems are much more costly to purchase and operate. They are used for high-value crops, not for traditional row crops. Many users employ computerization to optimize watering frequency and volume. In addition, all container nursery growers recycle water. All TVID irrigation use is metered and, as noted above, the water rate structure provides users with a strong incentive to conserve water.

FUTURE DEMAND

There is currently an adequate water supply for agricultural irrigation within the TVID service area. The production of containerized and field nursery stock, which uses more water than other crops, has been increasing however. If this trend continues, the current supply may be inadequate.

Climate change may also influence future demand and supply. In "The Impacts of Climate Change on Portland's Water Supply" (Palmer and Hahn, 2002), using four models that provided similar results, the authors predicted that there will be a general warming trend through the year 2040. The authors also predicted that there will be an increase in precipitation during the winter and a decrease during the summer. Warmer, dryer summers would increase the demand for agricultural irrigation.

As noted above, approximately 10,500 acres both inside and outside the TVID service area are currently irrigated with water drawn directly from the Tualatin River and its tributaries. During dry years there are water shortages. In the future, the shortages could worsen if compliance with the ESA and the Clean Water Act requires that additional water be left in streams during the dry months. To prevent such shortages from occurring, TVID's pipeline would need to be extended to land that is currently not served by TVID. Based on current usage, an additional 2,000 AF of water supply would be needed for almost every 1,000 acres converted from direct stream withdrawal to TVID's pipeline.¹ As much as 21,000 AF would be needed if all the acreage were converted.

MUNICIPAL DEMAND PROJECTIONS

Municipal and industrial (M&I) demand is projected to increase in the Basin over the next 50 years as a function of population growth. Water providers are required by state law to prepare master plans for the orderly growth of the water system. These plans are important because they allow the water provider to identify current and future system deficiencies and to adequately plan for necessary capital expenditures. Such planning is critical for the reliable delivery of high quality water. Planning efforts must consider supply, treatment, storage, distribution and operation and maintenance requirements of the system.

Water demand projections for the WSFS were prepared by compiling information from the most current master plans of the participating cities and water districts. Table 2-2 summarizes demand projections to the year 2050. Demand is presented in terms of peak season requirements. For municipal providers, "peak season" is defined as the 180-day period from May 1 to October 30. As shown in Table 2-2, current peak season demand for the Tualatin Basin is about 16 billion gallons (49,000 AF). This demand is projected to almost double by the year 2050, reaching a total of 30 billion gallons (92,000 AF).

Water demand projections are based on multiple assumptions, including population trends, economic conditions, climatic conditions and other factors. The methodology for calculating demand can also vary widely, ranging from the use of complex models to the application of simple factors based on historical data. The estimates given here are based on data from individual providers. They do not reflect potential long-term effects of global climate change, which may include higher summer temperatures and therefore increased peak season demand. It is important that water demand projections be regularly reviewed and updated based on available information.

¹ The usage ratio of one AF per acre does not include any delivery factor that might be applicable to account for system losses. The use and size of a delivery factor depends on the means of water conveyance. The current TVID pipeline delivery factor is 1.88, which means that for every AF of water applied to land, 1.88 AF must be released from Hagg Lake. This reflects the fact that some of the water released from the lake for irrigation purposes bypasses the intake at the water pumping facility.

**Table 2-2
Projected Peak Season Municipal Demand**

Water Provider	Projected Peak Season Demand (BG)										
	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
Beaverton	2.4	2.6	2.8	3.0	3.2	3.5	3.5	3.5	3.5	3.5	3.5
Hillsboro	2.8	4.7	6.2	6.5	6.7	6.9	7.1	7.2	7.3	7.3	7.4
Forest Grove	0.9	1.0	1.1	1.3	1.4	1.6	1.8	1.8	1.8	1.8	1.8
Tualatin Valley WD	6.0	6.9	7.8	8.9	9.9	10.0	10.2	10.3	10.4	10.5	10.6
Tigard	1.6	1.7	1.8	1.9	1.9	1.9	2.0	2.0	2.0	2.0	2.1
Tualatin	1.1	1.2	1.3	1.5	1.6	1.7	1.8	2.0	2.1	2.2	2.4
Raleigh	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Sherwood	0.3	0.5	0.7	0.8	1.0	1.0	1.1	1.1	1.1	1.2	1.2
Cornelius	-	-	-	-	-	-	-	-	-	-	-
Banks	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5
Gaston	-	-	-	-	-	-	-	-	-	-	-
North Plains	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.4	0.5
TOTAL	15.9	19.4	22.6	24.5	26.5	27.6	28.4	28.9	29.4	29.7	30.1

Note: Cities of Cornelius and Gaston demand are included with Hillsboro.

Some of the participating water providers of the WSFS are also members of the Regional Water Provider’s Consortium (the Consortium). This group is conducting an update to the 1996 RWSP. As part of the update, regional demand projections will be revised, and should be available by the fall of 2003. Regional water sources will also be reviewed, and estimates of developable yield will be created. The RWSP information should be reviewed as it becomes available, and compared to the numbers presented here.

In order to estimate future supply needs for the M&I sector, demand projections must be compared to existing supplies. Table 2-3 estimates the peak season source capacity for Tualatin Basin water providers. Total existing capacity is about 21 billion gallons (64,000 AF). Existing supplies are a combination of stored water in Hagg Lake and Barney Reservoir, natural flow rights on the Tualatin River and its tributaries, groundwater and wholesale purchase from the City of Portland.

Estimates of peak season stored water supply do not account for the long-term effects of climate change and the need to increase stored water reserves to provide reservoir “carryover” for drought protection. Similarly, estimates of supply from natural flow do not account for the potential of reduced availability as a result of long term climate change. These complexities will be addressed as part of the RWSP Update project, and may lower the peak season supply estimates presented here.

Considering the water demands of the Basin in the aggregate, peak season municipal demand will exceed existing supplies before 2010. It should be noted that individual providers may experience shortfalls much earlier than this. In particular, the City of Tigard is already taking measures to cover peak season shortages. The City of Hillsboro is also projected to need additional summer supply within the next few years. The smaller communities of Sherwood, Banks and North Plains that have traditionally relied on local groundwater are under pressure to find alternative water sources quickly, as the reliability of their supplies drops. The Tualatin

Valley Water District will require additional supply in about the 2010 time frame, while other communities including the cities of Tualatin, Forest Grove, Raleigh and Beaverton can delay source expansion to beyond 2010. Ultimately, about 10 billion gallons of new municipal supply (30,000 AF) is needed to meet municipal demand to the year 2050.

TOTAL WATER DEMAND PROJECTIONS

This section has discussed increased water demands for three sectors: instream flow augmentation, irrigation and M&I supply. The WSFS seeks to evaluate alternatives for assuring a long-term, reliable supply to meet these demands. In summary, the demand projections for the Tualatin Basin to the year 2050 include:

- Instream flow needs for an additional 15,000 AF (4.9 billion gallons);
- Irrigated agriculture need of 2,000 AF (0.65 billion gallons); and
- Municipal and industrial need for an additional 30,000 AF (7.2 billion gallons).

The total identified additional water need for the Basin by 2050 is 47,000 AF, or about 15 billion gallons.

This estimate may be low, considering the impacts of global warming, which are not reflected in the demand projections for any of the three water-using sectors. The demand numbers shown here also do not take into account the desire for redundancy or reliability of supply. In order to guarantee water supply from year to year, it may be prudent to include a “carry-over” factor to provide water supply in abnormally dry years. Consideration of these points could increase the overall demand projection to about 50,000 AF of new supply. Additional demand evaluations will be undertaken in the EIS process.

Table 2-3
Peak Season Source Capacity

Water Provider	Source Name	Peak Season Source Capacity	
		acre-feet	BG
Beaverton	Tualatin/Trask (1)	7,258	2.37
	ASR (9)	2,485	0.81
	subtotal	9,743	3.18
Hillsboro	Tualatin/Trask (1)	9,720	3.17
	Tualatin/Haines Falls (2)	184	0.06
	Tualatin River flows (6)	2,258	0.74
	subtotal	12,162	3.96
Forest Grove	Tualatin/Trask (1)	3,816	1.24
	Clear Creek	552	0.18
	subtotal	4,368	1.42
Tualatin Valley WD (4)	Portland/WCSL (5)	19,454	6.34
	Tualatin/Trask (1)	5,498	1.79
	subtotal	24,952	8.13
Tigard	Portland (13)	3,682	1.20
	subtotal	3,682	1.20
Tualatin	Portland/WCSL (8)	4,971	1.62
Raleigh	Portland/WCSL (12)	3,160	1.03
Sherwood	Groundwater	0	0.00
Cornelius	Hillsboro	-	-
Banks	Groundwater (10)	374	0.12
Gaston	Hillsboro	-	-
North Plains	Groundwater	184	0.06
TOTAL		63,598	20.7

1 - from draft JWC Planning Report

2 - assumes 0.5 mgd diversion is available for peak season, over 120 days

4 - does not include TVWD's 130 mgd water right on Willamette River

5 - assumes TVWD's share of WCSL of 42.3 mgd, over typical 150-day Bull Run drawdown period

6 - from Hillsboro Water Master Plan, 2000

8 - includes 10.8 mgd of supply from WCSL, over 150-day drawdown

9 - assumes 4.5 mgd of ultimate capacity, over 180 days

10 - assumes source capacity is one 350 gpm well operating at 16 hrs per day.

11 - assumes 180-day peak season

12 - assumes 6.9 mgd in WCSL, over 150-day drawdown period

13 - current contract amount

BG = billion gallons

WCSL = Washington County Supply Line