

APPENDIX G

IRRIGATION AND AGRICULTURE

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EM4824

Alfalfa Irrigation Management

Mature, healthy and productive alfalfa stands have developed an extensive crown and root system, enabling the crop to withstand adverse climatic conditions such as drought. Younger stands will not have as well developed crowns or root structures and will be more prone to drought-induced stresses. Following are some strategies for maintaining alfalfa when irrigation water is in short supply.

Maintain Root Carbohydrate Levels

Alfalfa roots store starch for the plant's winter survival, spring growth and postharvest regrowth. During the winter months alfalfa crowns and roots respire, using stored energy to survive. If the crown and roots were fully charged the previous fall, under normal conditions winter survival is of little concern. However, if plants were stressed in the fall, they will be more vulnerable to extremes in the environment. Thus, fall management is very important for winter survival and initial spring growth.

As soils warm in the spring, the new branch or crown buds begin growth, fed by mobilized starch stored in the crown and roots. The new growth continues to draw upon the stored energy until topgrowth reaches about 8 inches in height. Subsequent growth reverses the energy flow back to the storage structures in the roots and crown. Starch concentration peaks at full bloom. In a drought year, where fewer than normal harvests will likely be made, it is important to ensure root reserve recharge before each harvest. Avoid harvesting early. Weakened plants are more prone to winter injury.

Plant Nutrition

Soil testing is important in a drought year. Nitrogen fixation by rhizobia will be reduced under moisture stress. This means that lower than normal applications of plant nutrients are necessary. However, well-fed plants withstand drought conditions better and use less water to produce the comparable amounts of forage for harvest. Adequate phosphorous (P) is necessary for root growth and new stem bud development. Overfertilization with potassium (K) may lead to excessive amounts in cattle feed (over 3.5%). This can lead to metabolic disorders, calving problems and displaced abomasums.

Alfalfa's boron (B) needs should be maintained; however, excessive boron in feed is also toxic to livestock.

Normally, alfalfa does not accumulate excessive nitrates in the forage. However, drought-stressed alfalfa can accumulate potentially toxic levels of nitrates. In nitrate-N concentrations, expressed on a 100% dry matter basis, less than 0.17% (1700 ppm) should be safe in hay and haylage. If fed as green chop or grazed, the upper limits are 0.34% (3400 ppm) and 0.45 % (4500 ppm), respectively. Growers may want to add a test for nitrate-N when submitting samples for forage quality analyses.

Weed Control

Weeds waste valuable irrigation water. Identify and control weeds early in the season to conserve as much water for the alfalfa crop as possible.

Follow all label directions when handling and applying herbicides. If weed infestations are high, consider replacing the stand with a more water-efficient rotation crop. Rotating alfalfa is effective in reducing certain weeds, insect, disease, and nematode pests.

Irrigation Management

Alfalfa grown for forage in the arid Northwest normally requires from 1.8-acre feet (for 180-day growing season) to 3.2-acre feet (for 200-day growing season) of water. When irrigation supplies are limited, growers may want to alter their normal irrigation management.

In some heavier Columbia Basin soils, moisture accumulation from the previous fall irrigation and winter precipitation may be sufficient to support growth for the first harvest. Monitor soil moisture. Irrigate only if moisture stress is likely to impact first cutting yields. Plant stress can occur when available soil moisture decreases below 50%. If sufficient water is available for irrigation after the first harvest, use it early in the season. In a four-cut harvest system, the first cutting usually makes up about 35% to 38% of the year's total forage produced. In a five-cut harvest system, the first cutting yields contribute about 27%.

Drought-stressed alfalfa matures earlier, thus forage quality will peak earlier and degrade more rapidly than under normal conditions. Growers should analyze markets to determine whether to maximize forage quality or season yield. Managing for higher season yields will increase the chances for longer stand life.

Under moderate moisture stress, alfalfa plants have the ability to go into a drought-induced dormancy. Growth slows or completely ceases until moisture returns. Plant death due to extended drought is more likely in sandy soils. Upon rewetting of soils, plants will resume growth, but they will grow more slowly than normal. Avoid irrigating drought-induced dormant alfalfa until late in the fall, when lower temperatures will maintain dormancy. This will preserve stored root reserves for winter maintenance and spring growth.

Minimize Wheel and Animal Traffic

Dormant alfalfa is susceptible to damage by machinery and overgrazing. Crown buds may have formed, waiting for sufficient moisture and warmth to grow. Injury to crown tissue from wheel and hoof traffic can lead to infection by disease organisms, shortening stand life.

Information on soil moisture monitoring and crop evapotranspiration from Washington's Public Agricultural Weather Stations (PAWS) and Washington Irrigation Scheduling Expert (WISE) are available on the Scientific Irrigation Scheduling (SIS): web page
<http://sis.prosser.wsu.edu>

Drought advisories and other Washington State University Cooperative Extension Bulletins are available online at
<http://pubs.wsu.edu>
Type "drought" in the search box for downloadable files.

Revised by Steve Fransen, Ph.D., Washington State University Cooperative Extension forage specialist, WSU Prosser; and John Kugler, Ph.D., WSU Cooperative Extension forage agronomist, Grant County, including material by David W. Evans, former WSU agronomist, and William P. Ford, former WSU Cooperative Extension area agent.

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DROUGHT ADVISORY

EM4915

MANAGING IRRIGATED PASTURES AND GRASS HAY LAND

Drought, an environmental stress with periods of limited or no water during the growing season, reduces forage production for grazing and haymaking. Prolonged drought forces livestock and hay producers to better manage their fields to minimize recovery after the drought ends. Forage produced during a drought may be so stressed that livestock risk death by simply eating it. Following are several strategies to maintain healthy perennial pastures and hayfields, to reduce loss of livestock from consuming drought stressed forage; and practices to consider after the drought ends.

Strategy 1.

Protect Plant Crowns

The safety mechanism for survival of grass legume plants on irrigated pastures and grass hay lands is the plant crown. A crown develops at the base of all pasture grass and legume plants as they mature. The crown may be referred to as "the stubble" or "that bottom 3 or 4 inches of growth next to the soil surface." Each crown acts as a bank account for the plant, storing sugars and carbohydrates for plant growth and life-supporting respiration. Without an adequate crown many forage plants simply die. Crown loss is one of the main reasons why pastures deteriorate from overgrazing. Because the crown stores sugars, livestock want to graze down to the soil surface to eat these sweet plant tissues.

Avoid grazing all pastures below 3-inch stubble height. You can easily measure stubble height with a ruler over a pasture. To ensure pastures are not overgrazed, designate a sacrifice area to restrict damage to one location for the duration of the drought. By feeding hay or other feedstuffs in the sacrifice area you will protect crowns of the

highly productive perennial forages. Above all, save the crown.

Strategy 2.

Know the Plants in the Pastures

Identify the dominant grasses and legumes in each field so you can increase management flexibility and prioritize fields that can withstand drought from those that cannot. Drought tolerance is related to extensiveness and depth of roots. Orchardgrass and tall fescue have larger and deeper root systems, characteristics that make them more tolerant of droughty conditions. You can identify desirable grasses by vegetative parts; for example, orchardgrass always has flattened stem bases at the crown.

Weeds are water wasters. Identifying and controlling weeds early in the season will save valuable water and increase quality of forage. Some weeds accumulate high concentrations of nitrates, which can harm livestock.

Strategy 3.

Soil Sample and Change Fertilizer Applications

Take soil samples as early as possible. To rebuild their root systems every year, forage plants require adequate phosphorus. Apply phosphorus as early as possible to stimulate root rebuilding. Maintain soil potassium and sulfur based on soil test results. Reduce nitrogen applications by 50% or more. This will reduce total forage yield but the forage produced should be lower in nitrates that may cause nitrate poisoning and death in livestock. Nitrate poisoned livestock will have chocolate brown blood that quickly turns red once exposed to air. Test all grazed and cut hay forage for nitrate poisoning before feeding to livestock.

Monitor forage nitrate levels closely if grazed, as nitrates increase with greater drought stresses.

Strategy 4.

Rotational Grazing

By using rotational grazing, you allow the pastures longer to recover if they have received any irrigation water or rainfall. Longer recovery periods, and use of a sacrifice area, will ensure maintaining the stubble height at 3 inches and more. We do not recommend feeding hay on the pasture since livestock will still want to eat the stubble with its higher sugar concentrations. If you plan to take land out of perennial pastures for the summer, plant with a summer annual crop such as sudangrass for higher forage production during the highest heat of the season. Rotational grazing of sudangrass will be important. Leave at least a 6-inch stubble after each grazing.

Strategy 5.

Reducing Herd Size or Purchasing Additional Forage

Using low quality forage or grass seed straw and cheaper supplements may prevent excess culling of the herd. Purchase cheaper forage products early and use them to save both the herd and replanting an overgrazed, destroyed pasture. Often the cost of reseeding will exceed \$200 per acre, before labor costs. Also count the loss of forage during the time it would take for the new pasture to become established. Overgrazing a pasture during droughty conditions will prove "penny wise and pound foolish" for the next 10 years. If the herd needs to be culled, do it early to save as much forage as possible for those animals that remain.

Strategy 6.

How to Repair a Damaged Field

Pasture plants that were strong before the drought have a better chance of recovery than those constantly overgrazed. Weaker plants will die, leaving bare spots and holes on the soil surface. Because blowing weed seeds can establish themselves in the

bare spots, early identification and control of establishing weed seedlings is important. Increasing phosphorus applications will enhance forage root development making plants stronger and better able to compete with weeds and drought in the face of environmental stress. Continue limiting nitrogen until plants have increased the crown area and have begun new crop development.

In some cases, overseeding is possible, but certain conditions should be met to increase success. Harrow the pasture with tines down to scratch and open up the surface. Broadcast or drill the seed at about 1.5 times the recommended seeding rate when rains or irrigation water return. For forage grasses and legumes, the depth of seeding should not exceed 1/2 inch. Plant small seeds more shallowly than large seeds. When sowing mixtures, the depth of seeding should favor the smaller seeded species. Graze the pastures after overseeding until the new grass is about 4 inches tall, then remove livestock. Allow the newly establishing plants an opportunity to grow and reach sunlight. After establishing plants reach about 10 inches in height, graze lightly for the remainder of that season. Light grazing will allow the new plants to develop their own crowns for overwintering and survival.

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EM4856

Water Conservation, Weed Control Go Hand in Hand

Weeds, like other plants, consume large quantities of water, and most of it is lost by transpiration to the atmosphere. Plants with deep roots have an advantage under conditions of moisture stress. Growth of common lambsquarters, kochia, and Russian thistle is less affected by a shortage of moisture than is growth of many crops.

Importance in Dry Years

Research concerned with common annual weeds and with their water use requirements, compared with those of agricultural crops, shows that weed control must become an integral part of the farming operation. Weed control is even more important during years of water shortage. When moisture is in short supply, weeds can reduce crop yields more than 50% through moisture competition alone.

Weeds Need More Water than Many Crops

Some common annual weeds growing in association with cultivated crops use up to three times as much water to produce a pound of dry matter as do the crops. For example, common lambsquarters requires 658 pounds of water to produce one pound of dry matter, common sunflower requires 623 pounds, and common ragweed 912 pounds, compared with 349 pounds for corn and 557 pounds for wheat.

The same figures can be expressed in gallons of water required to produce one pound of dry matter. Lambsquarters requires nearly 79 gallons of water to produce one pound of dry matter, and ragweed 109 gallons as compared with only 42 gallons for corn and 67 for wheat.

The amount of water used by an infestation of lambsquarters, if it were conserved through adequate weed control practices, could produce an additional 1.9 tons per acre of corn and 1.2 tons per acre of wheat.

In a 2-year field study, each Russian thistle plant removed an average of 18 gallons of water while competing with the spring wheat crop (mid-April to early August). In addition, each plant used 26 more gallons from crop harvest to killing frost (October).

Other competitive annual weeds common to crops in Washington also show negative values. It has been estimated that one wild sunflower plant uses about the same amount of moisture required to grow one potato plant, or nearly two and one-half corn plants. One common mustard uses as much moisture as four wheat plants, and one Russian thistle uses as much moisture as three sorghum plants. Roots on some weeds, such as Russian thistle, develop much faster than roots of the crop with which it is competing. This allows the faster developing weeds to reach deeper soil moisture first.

Annual weed competition studies conducted in field beans by the USDA-ARS in cooperation with Washington State University showed that annual weeds reduced bean yields from an average of 2795 pounds per acre to less than 900 pounds per acre.

Moisture was not the limiting factor in these studies, but other research has shown that interactions compound the advantage to the weeds in a competitive system. Thus, if weeds suppress crops

by shading them, the crops are less able to compete for water and nutrients, and severe yield reductions result.

Research and grower experience clearly points out the importance of a good weed control program in all crops when adequate water is available. One can imagine the seriousness under limited irrigation water.

Weeds on Dryland

Under dryland conditions, weeds usually cause the most severe reduction in yield the first two or three weeks of crop growth. Good preplant or preemergence weed control and early post-emergence weed control seem to be essential for maintaining or maximizing yields.

Row crops and forage crops under irrigation are not the only production areas to suffer during drought years. If less water is available on rangelands, we may see fewer plants growing in a given area. This thinning will open up more sites for invasion by weeds. We may see a *normal* weed, such as downy brome, replaced by a more serious weed, such as one of the knapweeds.

Drought Effects on Herbicides

The efficacy of most herbicides depends on water. Soil applied herbicides are less active under drought conditions. This is especially true of pre-emergence herbicides that require overhead moisture to move into the soil where weed seeds germinate. A harrowing or rotary hoeing can help incorporate herbicides and remove escaped weeds where adequate moisture has not occurred. However, tillage can expose the soil to further drying.

Postemergence herbicides perform best when weeds are actively growing. High temperature,

high relative humidity, and adequate soil moisture are ideal. Drought stress of weeds reduces herbicide effectiveness. Weeds are not able to grow as rapidly with limited moisture. Weeds also develop a thicker wax layer, or cuticle, on their leaves to reduce moisture loss during dry conditions. This can reduce the ability of postemergence herbicides to enter weed foliage. Herbicide adjuvants can help increase the penetration of the herbicide into the leaf. However, adjuvants may reduce the selectiveness of selective herbicides and increase crop injury.

Weed control programs are needed to maintain economic levels of crop production, even under optimum growing conditions. Weed control becomes even more important in dry years. Good weed control means higher crop yields and higher net returns per acre.

Outstanding weed control programs have been developed for many Washington crops. Growers should consider weed control an important part of every crop production plan.

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Alberta Conservation Connection

From Abandoned Irrigation Ditch to Wildlife Habitat

[About Alberta Conservation Connection](#) > - Issue 9, Fall 1999

The sound of wind sifting through the cattails and calls of red-winged blackbirds fill the air at a 40-acre site owned by Lakeside Farm Industries at Brooks. The efforts of many partners have converted the site's abandoned irrigation ditch into an important part of a larger wildlife habitat strategy.



An old irrigation ditch provides wetland habitat

Seepage from the old ditch had made this area unsuitable for agriculture. However, the seepage also supported a large cattail marsh with willows, poplars and other plants, providing good wildlife habitat. With the installation of a new, efficient irrigation pipeline to conserve water, the seepage was eliminated, threatening the existence of the marsh.

"The original canal made a loop around this low marsh area because, when the system was constructed 85 years ago, all canals were designed to follow the land contours," explains Rick Martin, Wildlife Projects Manager for the Eastern Irrigation District (EID). When the new pipeline was installed, it followed the property line, rather than the topography. "Instead of back-filling in the old canal as is often done, Lakeside agreed to leave the old canal in place and retain the

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habitat area."

Processors

The next concern was how to supply water to the marsh. "We brought a service off the main pipeline to feed water to the abandoned ditch, which is approximately one kilometre long," says Martin. "Then when water demand for other uses is low, we can recharge the old ditch two or three times a year to maintain the habitat area." Not only is this site an important pheasant wintering area, it is also home to deer, birds and other wildlife.

This marsh is just one component of a much larger effort to enhance wildlife habitat, under the County of Newell's Alberta Environmentally Sustainable Agriculture (AESAs) Program and the EID's Partners in Habitat Development (PHD) Program.

"Under the EID-PHD project, we have one full-time Habitat Technician, and this year we hired three university summer students to assist with tree planting and maintenance," says Martin. "Although we initially tried to start small, the project has expanded to include over 70 interested private landowners through word of mouth."

Potential habitat areas to be developed include: 30,000 ac (12,000 ha) of EID-owned right-of-ways; 10,000 ac (4,000 ha) privately owned pivot corners; further enhancement of 10,000 ac (4,000 ha) of existing habitat projects within the cultivated regions of the district; and other private land areas.

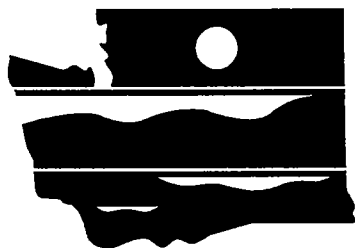
The program is fairly ambitious, with the 1999 budget at \$110,000 and many partners including: EID, Pheasants Forever (Calgary Chapter), Alberta Conservation Association, Ducks Unlimited Canada, Alberta Natural Resources Service, County of Newell, Brooks and District Fish and Game Association, Brooks Pheasant Festival Committee, Alberta Agriculture, Food and Rural Development, and PFRA. Steve Wylie, the Agricultural Fieldman for the County of Newell, has worked closely with the EID on this project. AESA funds supported the building of the pipeline service and partially assisted with hiring seasonal staff.

One of the program's main focuses is on planting trees and shrubs along pipelines in the irrigation system, to link habitat areas. For example, many landowners are prepared to set aside a 50 m strip alongside the pipeline for habitat enhancement.

"We're also paying input costs to landowners to leave two or three acres of crop out as winter food plots," explains Martin. "And we're assisting landowners with fencing off willow habitat in cattle wintering areas, which stops the cattle from damaging the trees but still provides some shelter for cattle." The program provides the fencing materials and landowners build the fences.

"We're pleased with how the various partners have come together to work on this program," says Martin. "We've also had some interest from other irrigation districts, and hope that they will pick up on this program as well."

For more information, contact Rick Martin.



WASHINGTON STATE
DEPARTMENT OF
E C O L O G Y

2002 Report to the Legislature

**Allocation of Accumulated
Columbia Basin Groundwater**

January 2003

Publication No. 03-11-002

Executive Summary

During the past 50 years, irrigation of the central Columbia Basin has transformed the basin from an area of rangeland and dryland farming into an area with some of the most productive agricultural lands in the country. Imported irrigation water over the last 50 years has infiltrated into the ground and commingled with the naturally occurring groundwater. In some areas of the Columbia Basin, there are significant amounts of stored water as a result of the Columbia Basin project.

Chapter 508-14 WAC sets forth interim policies to guide the Department of Ecology (Ecology) in granting the authority to make withdrawals of commingled naturally occurring and artificially stored groundwater. Substitute House Bill (SHB) 2874 allows the department of Ecology and United States Bureau of Reclamation (USBR) to enter into agreements to allocate groundwater within the geographic area of the WAC 508-14. The legislature through passage of SHB 2874 required Ecology to report annually in December on progress to implement the legislation.

Implementation Progress

In early spring of 2002 after the passage of SHB 2874, Ecology and the USBR met together with the Columbia Basin irrigation districts to discuss post legislation work plans and information needs. Two formal committees were established:

1. A policy committee comprised of senior managers and legal counsel from Ecology, USBR and the Columbia Basin irrigation districts. The policy committee would decide and craft the agreement, determine if additional technical studies are needed, and allocate resources to accomplish a pilot program to allocate water within the WAC 508-14 area.
2. A technical committee comprised of senior hydrogeologists and engineers from Ecology, USBR and the Columbia Basin irrigation districts. The technical committee would review the technical reports and groundwater data and make recommendations to the policy committee concerning impacts to the Columbia River system and Columbia Basin project operations.

Additionally, at the spring meeting a decision was made to have the technical committee review the existing United States Geological Survey (USGS) report for the Pasco Basin, which includes the WAC 508-14 area, and update the report with any current data and make a recommendation on allocating water for a pilot project. The pilot project would allocate blocks of water from the Franklin County portion of the 508-14 area for 50 pending applications and would reserve water for future uses.

The technical committee met several times throughout the spring and summer of 2002 and developed a technical memorandum in August of 2002. The technical committee determined that a pilot program to allocate 16,000 acre feet of water could safely be done from the WAC 508-14 area with minimal impact to the Columbia River system.

Future Efforts Required to Implement SHB 2874

A meeting is scheduled for December 19, 2002 with the policy committee and technical committee to discuss the following actions to implement SHB 2874:

- Review of the technical committee memorandum with the Columbia Basin irrigation districts and the recommendations within the report.
- Discuss a strategy for consultation by USBR and Ecology with National Marine Fisheries Service regarding the potential impact to the Columbia River from the WAC 508-14 pilot program.
- Scope the development of the agreement required within SHB 2874 and develop timelines to finalize the agreement
- Development of a draft scope of work for collection of groundwater monitoring data within the pilot project area.
- Discuss proposed rule language to revise WAC 508-14 rule to implement SHB 2874 and the agreement between the USBR and Ecology.

CHAPTER 173-136 WAC
THE ESTABLISHMENT OF A SYSTEM OF AUTHORIZING THE
WITHDRAWAL OF ARTIFICIALLY STORED GROUND WATERS
EMBODIED IN AN APPROVED DECLARATION UNDER RCW 90.44.130,
WHICH ARE COMMINGLED WITH PUBLIC GROUND WATERS IN
GROUND WATER AREAS, SUBAREAS, AND ZONES ESTABLISHED
UNDER RCW 90.44.130

Last Update: 6/9/88

WAC

173-136-010	Purpose of chapter.
173-136-020	Definitions—This chapter.
173-136-030	Permit to withdraw.
173-136-040	Criteria for ruling upon application for permits.
173-136-050	Public notice of application and public hearings—When required.
173-136-060	Permits—Priorities and conditions of right of withdrawal.
173-136-070	Permits do not establish or embody water rights.
173-136-080	Permits shall be transmitted to the holder of a declaration.
173-136-090	Failure to obtain permit—Unlawful.
173-136-095	Enforcement.
173-136-100	Appeals.
173-136-110	Regulation review.

WAC 173-136-010 Purpose of chapter. The purpose of this chapter is to establish a permit system as a part of a comprehensive state water management and regulatory control program pertaining to the withdrawal and use of ground waters consisting of commingled artificially stored ground waters and public waters located in areas, subareas, and zones designated pursuant to RCW 90.44.130. The permit system established in this chapter relates only to the withdrawal and use of artificially stored ground waters of such ground waters.
[Order 74-36, § 173-136-010, filed 1/9/75.]

WAC 173-136-020 Definitions—This chapter. Definitions. For purposes of this chapter the following definitions shall apply. (It is noted that the (2) and (6) hereof are not intended to be identical with definitions contained in RCW 90.44.035.)

- (1) "Area, subarea, or zone" means a ground water area, subarea, or zone designated by the department of ecology pursuant to RCW 90.44.130(3), which contains commingled artificially stored and public ground waters.
- (2) "Artificially stored ground waters" mean water beneath the land surface within an area, subarea, or zone(s) which are the subject of a declaration accepted by the department of ecology pursuant to RCW 90.44.130(6).

- (3) "Department" means the department of ecology.
- (4) "Ground waters" means all waters beneath the land surface of an area, subarea, or zone.
- (5) "Person" means individual, public, or private corporation, municipality, county, partnership, association, federal, or state agency or body, or any other entity whatsoever.
- (6) "Public ground waters" means all ground waters within an area, subarea, or zone other than artificially stored ground waters.

[Order 74-36, § 173-136-020, filed 1/9/75.]

WAC 173-136-030 Permit to withdraw. No person, unless expressly exempted by a specific management regulation of the department adopted for an area or subarea, may withdraw any artificially stored ground waters for beneficial use from any area, subarea, or zone without first obtaining a permit from the department of ecology as hereinafter provided. An application for a permit shall be submitted on a form provided by the department. The application shall contain the following information:

- (1) Name
- (2) Address
- (3) Point of withdrawal
- (4) Place of use
- (5) Purpose of use
- (6) Time of use
- (6a) Amounts of withdrawal, including both maximum rate and the total volume each calendar year
- (7) The area, subarea, and zone from which the waters are to be withdrawn.

[Order 74-36, § 173-136-030, filed 1/9/75.]

WAC 173-136-040 Criteria for ruling upon application for permits.

- (1) The criteria for ruling on an application for a permit are as follows. An application shall be approved if:
 - (a) Artificially stored waters are available for withdrawal; and
 - (b) The public interest will not be detrimentally affected; and
 - (c) Rights to withdraw public water will not be impaired; and
 - (d) The interests of the holder embodied [embodied] in a declaration accepted by the department pursuant to RCW 90.44.130(6) will not be impaired.
 - (e) The withdrawal and use proposed in the application can be performed consistent with the provision of the chapter of the Washington Administrative Code containing the water management and regulation regulations for the specific ground water area, subarea, or zone to which the application relates.

- (2) Prior to issuance of a permit to withdraw artificially stored ground water, the department shall consult with the holder of a declaration accepted by the department pursuant to RCW 90.44.130.

[Order 74-36, § 173-136-040, filed 1/9/75.]

WAC 173-136-050 Public notice of application and public hearings—When required.

- (1) Public notices of applications filed with the department shall be required by the department only when it appears to the department that the public interest will be served. When a notice is required the applicant shall be responsible for its publication in a form, manner, and frequency as determined by the department unless otherwise specified.
- (2) Public hearings on such applications shall be required by the department only when it appears to the department that the public interest will be served.

[Order 74-36, § 173-136-050, filed 1/9/75.]

WAC 173-136-060 Permits—Priorities and conditions of right of withdrawal. Every permit issued pursuant to this chapter shall be:

- (1) Conditioned to insure the protection of public interest and values and of the rights of withdrawal and use established in public waters and artificially stored ground waters both prior and subsequent to the issuance of such a permit.
- (2) Conditioned to comply with the provisions of the chapter of the Washington Administrative Code containing the water management and regulation regulations for the specific ground water area, subarea, or zone to which the application relates.
- (3) Conditioned to provide for inspection, monitoring, entry, and reporting of data by or to the department and the holder of an accepted declaration as required by the department.
- (4) Conditioned to provide that a permit shall be subject to termination or modification for failure to comply with any agreement, approved by the department, between the permittee and the holder of a declaration accepted by the department of ecology pursuant to RCW 90.44.130.
- (5) Subject to termination or modification, through issuance of supplemental orders of the department, for good cause, including but not limited to:
 - (a) Violation of a permit condition;
 - (b) Obtaining a permit by misrepresentation or failure to fully disclose all relevant facts;
 - (c) The receipt of new facts or information dictate the same.

[Order 74-36, § 173-136-060, filed 1/9/75.]

WAC 173-136-070 Permits do not establish or embody water rights. Permits issued pursuant to this chapter do not establish or embody water rights as provided in RCW 90.44.050 and 90.44.060.

[Order 74-36, § 173-136-070, filed 1/9/75.]

WAC 173-136-080 Permits shall be transmitted to the holder of a declaration. A copy of each permit issued by the department under this chapter shall be transmitted, at the time of issuance, to the holder of a declaration accepted by the department pursuant to RCW 90.44.130 pertaining to artificially stored ground water.

[Order 74-36, § 173-136-080, filed 1/9/75.]

WAC 173-136-090 Failure to obtain permit—Unlawful. Failure to comply with the provisions of this chapter, including failure to obtain a permit as required herein and violation of a condition of such a permit, shall constitute a basis for the imposition of civil and criminal sanctions contained in applicable state statutes.

[Order 74-36, § 173-136-090, filed 1/9/75.]

WAC 173-136-095 Enforcement. In enforcement of this chapter, the department of ecology may impose such sanctions as are appropriate under authorities vested in it, including but not limited to the issuance of regulatory orders under RCW 43.27A.190 and civil penalties under RCW 90.03.600.

[Statutory Authority: Chapters 43.21A, 43.27A, 90.03 and 90.44 RCW. 88-13-037 (Order 88-11), § 173-136-095, filed 6/9/88.]

WAC 173-136-100 Appeals. All final written decisions of the department of ecology pertaining to permits, regulatory orders, and related decisions made pursuant to this chapter shall be subject to review by the pollution control hearings board in accordance with chapter 43.21B RCW.

[Statutory Authority: Chapters 43.21A, 43.27A, 90.03 and 90.44 RCW. 88-13-037 (Order 88-11), § 173-136-100, filed 6/9/88; Order 74-36, § 173-136-100, filed 1/9/75.]

WAC 173-136-110 Regulation review. The department of ecology shall initiate a review of the rules established in this chapter whenever new information, changing conditions, or statutory modifications make it necessary to consider revisions.

[Statutory Authority: Chapters 43.21A, 43.27A, 90.03 and 90.44 RCW. 88-13-037 (Order 88-11), § 173-136-110, filed 6/9/88.]

RCW 90.44.130**Priorities as between appropriators -- Department in charge of ground water withdrawals -- Establishment and modification of ground water areas and depth zones -- Declarations by claimant of artificially stored water.**

As between appropriators of public ground water, the prior appropriator shall as against subsequent appropriators from the same ground water body be entitled to the preferred use of such ground water to the extent of his appropriation and beneficial use, and shall enjoy the right to have any withdrawals by a subsequent appropriator of ground water limited to an amount that will maintain and provide a safe sustaining yield in the amount of the prior appropriation. The department shall have jurisdiction over the withdrawals of ground water and shall administer the ground water rights under the principle just set forth, and it shall have the jurisdiction to limit withdrawals by appropriators of ground water so as to enforce the maintenance of a safe sustaining yield from the ground water body. For this purpose, the department shall have authority and it shall be its duty from time to time, as adequate factual data become available, to designate ground water areas or sub-areas, to designate separate depth zones within any such area or sub-area, or to modify the boundaries of such existing area, or sub-area, or zones to the end that the withdrawals therefrom may be administratively controlled as prescribed in RCW 90.44.180 in order that overdraft of public ground waters may be prevented so far as is feasible. Each such area or zone shall, as nearly as known facts permit, be so designated as to enclose a single and distinct body of public ground water. Each such sub-area may be so designated as to enclose all or any part of a distinct body of public ground water, as the department deems will most effectively accomplish the purposes of this chapter.

Designation of, or modification of the boundaries of such a ground water area, sub-area, or zone may be proposed by the department on its own motion or by petition to the department signed by at least fifty or one-fourth, whichever is the lesser number, of the users of ground water in a proposed ground water area, sub-area, or zone. Before any proposed ground water area, sub-area, or zone shall be designated, or before the boundaries or any existing ground water area, sub-area, or zone shall be modified the department shall publish a notice setting forth: (1) In terms of the appropriate legal subdivisions a description of all lands enclosed within the proposed area, sub-area, or zone, or within the area, sub-area, or zone whose boundaries are proposed to be modified; (2) the object of the proposed designation or modification of boundaries; and (3) the day and hour, and the place where written objections may be submitted and heard. Such notice shall be published in three consecutive weekly issues of a newspaper of general circulation in the county or counties containing all or the greater portion of the lands involved, and the newspaper of publication shall be selected by the department. Publication as just prescribed shall be construed as sufficient notice to the landowners and water users concerned.

Objections having been heard as herein provided, the department shall make and file in its office written findings of fact with respect to the proposed designation or modification and, if the findings are in the affirmative, shall also enter a written order designating the ground water area, or sub-area, or zone or modifying the boundaries of the existing area, sub-area, or zone. Such findings and order shall also be published substantially in the manner herein prescribed for notice of hearing, and when so published shall be final and conclusive unless an appeal therefrom is taken within the period and in the manner prescribed by RCW 43.21B.310. Publication of such findings and order shall give force and effect to the remaining provisions of this section and to the provisions of RCW 90.44.180, with respect to the particular area, sub-area, or zone.

Priorities of right to withdraw public ground water shall be established separately for each ground water area, sub-area, or zone and, as between such rights, the first in time shall be the superior in right. The priority of the right acquired under a certificate of ground water right shall be the date of filing of the original application for a withdrawal with the department, or the date or approximate date of the earliest beneficial use of water as set forth in a certificate of a vested ground water right, under the

provisions of RCW 90.44.090.

Within ninety days after the designation of a ground water area, sub-area or zone as herein provided, any person, firm or corporation then claiming to be the owner of artificially stored ground water within such area, sub-area, or zone shall file a certified declaration to that effect with the department on a form prescribed by the department. Such declaration shall cover: (1) The location and description of the works by whose operation such artificial ground water storage is purported to have been created, and the name or names of the owner or owners thereof; (2) a description of the lands purported to be underlain by such artificially stored ground water, and the name or names of the owner or owners thereof; (3) the amount of such water claimed; (4) the date or approximate date of the earliest artificial storage; (5) evidence competent to show that the water claimed is in fact water that would have been dissipated naturally except for artificial improvements by the claimant; and (6) such additional factual information as reasonably may be required by the department. If any of the purported artificially stored ground water has been or then is being withdrawn, the claimant also shall file (1) the declarations which this chapter requires of claimants to a vested right to withdraw public ground waters, and (2) evidence competent to show that none of the water withdrawn under those declarations is in fact public ground water from the area, sub-area, or zone concerned: PROVIDED, HOWEVER, That in case of failure to file a declaration within the ninety-day period herein provided, the claimant may apply to the department for a reasonable extension of time, which shall not exceed two additional years and which shall be granted only upon a showing of good cause for such failure.

Following publication of the declaration and findings -- as in the case of an original application, permit, or certificate of right to appropriate public ground waters -- the department shall accept or reject such declaration or declarations with respect to ownership or withdrawal of artificially stored ground water. Acceptance of such declaration or declarations by the department shall convey to the declarant no right to withdraw public ground waters from the particular area, sub-area, or zone, nor to impair existing or subsequent rights to such public waters.

Any person, firm or corporation hereafter claiming to be the owner of ground water within a designated ground water area, sub-area, or zone by virtue of its artificial storage subsequent to such designation shall, within three years following the earliest artificial storage file a declaration of claim with the department, as herein prescribed for claims based on artificial storage prior to such designation: PROVIDED, HOWEVER, That in case of such failure the claimant may apply to the department for a reasonable extension of time, which shall not exceed two additional years and which shall be granted upon a showing of good cause for such failure.

Any person, firm or corporation hereafter withdrawing ground water claimed to be owned by virtue of artificial storage subsequent to designation of the relevant ground water area, sub-area, or zone shall, within ninety days following the earliest such withdrawal, file with the department the declarations required by this chapter with respect to withdrawals of public ground water.

[1987 c 109 § 116; 1947 c 122 § 4; 1945 c 263 § 12; Rem. Supp. 1947 § 7400-12. Formerly RCW 90.44.130 through 90.44.170.]

NOTES:

Purpose -- Short title -- Construction -- Rules -- Severability -- Captions -- 1987 c 109: See notes following RCW 43.21B.001.

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[No. 58857-1. En Banc. May 20, 1993.] In the Matter of the Determination of the Rights of the Use of the Surface and Ground Waters of the Marshall Lake and Marshall Creek Drainage Basin in Pend Oreille County, Washington. THE DEPARTMENT OF ECOLOGY, Respondent, v. CLARENCE E. GRIMES, ET AL, Appellants, LEONARD B. MAGART, ET AL, Respondents.

[1] Equity - Appellate Review - In General. Appellate review of cases in equity is the same as for cases at law.

[2] Referees - Findings of Fact - Appellate Review - Standard of Review. An appellate court reviews findings of fact determined by a referee and confirmed by a trial court under the substantial evidence test.

[3] Waters - Water Rights - Appropriation - Beneficial Use - Test - Question of Law or Fact - Standard of Review. The proper test for determining beneficial use to water rights acquired

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by appropriation, including the identity and weight of factors used in the test, is a question of law that is reviewed de novo by an appellate court.

[4] Waters - Water Rights - General Adjudication - Nature of Action - Purpose. A general adjudication of water rights pursuant to RCW 90.03.110 et seq. is a special form of quiet title action for the purpose of determining and confirming all existing rights to the use of water from a specific body of water, regardless of whether the rights are riparian or appropriative and regardless of when they were acquired.

[5] Waters - Water Rights - Nature - Elements. A water right is composed of two elements: (1) the amount of water that may be put to beneficial use and (2) its priority relative to other water rights.

[6] Waters - Water Rights - Appropriation - Beneficial Use - What Constitutes - Nature. An appropriated water right is established and maintained by the purposeful application of a given quantity of water to a beneficial use upon the land. Such a right is appurtenant to the land, perpetual, and operates to the exclusion of later claimants.

[7] Waters - Water Rights - Appropriation - Beneficial Use - Elements. For purposes of appropriated

water rights, "beneficial use" has two elements: (1) the purposes or types of activities for which the water may be used and (2) the amount of water that may be used as limited by the principle of "reasonable use".

[8] Waters - Water Rights - Appropriation - Beneficial Use - Reasonable Use - Water Duty - What Constitutes. "Water duty" is the amount of water that, by careful management and use and without wastage, is reasonably required to be applied to a parcel of land for the period of time that is adequate to produce a maximum amount of such crops as ordinarily are grown on the land. "Water duty" varies according to conditions.

[9] Waters - Water Rights - Appropriation - Beneficial Use - Reasonable Use - Water Duty - Standard of Review. A determination of a water duty that is supported by a preponderance of the evidence will not be disturbed on appeal.

[10] Waters - Water Rights - Appropriation - Beneficial Use - Reasonable Use - Waste - What Constitutes. For purposes of appropriated water rights, the amount of water that constitutes a "reasonable use" is limited by the doctrine of waste. Water usage must be reasonably efficient and economical in light of other present and future demands upon the source of supply.

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[11] Waters - Water Rights - Appropriation - Beneficial Use - Reasonable Use - Waste - Irrigation - Factors - Local Customs - Effect. Whether appropriated water rights for irrigation are being wasted or are being used reasonably efficiently depends on such factors as the established means of diversion and application according to the reasonable custom of the locality and, under RCW 90.03.005, the costs and benefits of improvements to irrigation systems, including the use of public and private funds to facilitate improvements. The customary irrigation practices common to a locality do not, however, justify waste of water.

[12] Waters - Water Rights - Appropriation - Beneficial Use - Environmental Factors - Impairment of Water Rights. The impact that a beneficial use of water has on the water source and its flora and fauna is not a basis for impairing an existing water right.

[13] Waters - Water Rights - General Adjudication - Modification of Rights - Validity. A general adjudication of water rights pursuant to RCW 90.03.110 et seq. cannot reduce, enlarge, or modify existing water rights, whether riparian or appropriative.

[14] Waters - Water Rights - Nature - Vested Rights. Property owners have a vested interest in their water rights to the extent that the water is beneficially used on the land.

[15] Waters - Water Rights - Appropriation - Abandonment - Reversion to State - Constitutional Taking. The relinquishment to the State, pursuant to RCW 90.14.160, of unused water rights acquired by appropriation does not result in a "taking" of property without just compensation within the meaning of the Fifth Amendment.

Nature of Action: The State sought clarification of existing rights to make beneficial use of the surface and ground waters of a lake and drainage basin.

Superior Court: Following submission of a referee's report, the Superior Court for Pend Oreille County, No. 83-2-00030-7, Fred L. Stewart, J. on January 5, 1990, entered a decree adjudicating the water rights.

Supreme Court: Holding that the referee's determination of the amount of water needed for irrigation was supported by the evidence, that the referee had properly determined

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the irrigation water rights of an aggrieved landowner, and that the decree did not result in a taking of private property, the court affirms the decree.

Robert L. Henry, for appellants.

Christine O. Gregoire, Attorney General, and Thomas McDonald, Assistant, for respondent State.
Robert E. Anderson, for respondents Magart.

Donald H. Bond on behalf of Union Gap Irrigation District, Yakima Valley Canal Company, Yakima-Tieton Irrigation District, West Side Irrigating Company, and Ellensburg Water Company; John P. Gilreath on behalf of Kittitas Reclamation District; Thomas A. Cowan on behalf of Reza Irrigation District; James E. Davis on behalf of Cascade Irrigation District; Charles C. Flower on behalf of Sunnyside Valley Irrigation District; Dwight A. Halstead on behalf of Prosser Irrigation District, City of Prosser, and Kiona Irrigation District; Floyd E. Ivey on behalf of Kennewick Irrigation District, City of Yakima, and Naches-Selah Irrigation District, amici curiae for appellants.

SMITH

MADSEN, J., did not participate in the disposition of this case.

SMITH, J. - This matter is before the court upon direct review after we accepted certification from the Court of Appeals, Division Three, pursuant to RCW 2.06.030(d), raising the question of the legal definition of "reasonable use" of water as an element of "beneficial use" under the Water Code of 1917, RCW 90.03, the Water Resources Act of 1971, RCW 90.54, and other related statutes. /1

Appellants Clarence E. and Peggy V. Grimes (Grimeses) appeal from a decree adjudicating water rights pursuant to RCW 90.03.200 entered by the Pend Oreille County Superior Court. Respondents are Leonard B. and Elsie E. Magart and the State of Washington Department of Ecology (Ecology). /2

1 Under RAP 4.3, certification by the Court of Appeals transfers the case to this court for disposition.

2 Defendants Elmer D. Allen, et ux. et al., designated here as respondents, are not before the court at this time, except that Leonard B. and Elsie E. Magart have

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We affirm the Superior Court.

In September 1981, the Department of Ecology filed a petition in the Pend Oreille County Superior Court for clarification of existing rights to divert, withdraw, or otherwise make beneficial use of the surface and ground waters of the Marshall Lake and Marshall Creek drainage basin (Marshall Lake basin). Ecology investigated the Marshall Lake basin and the locality served by it and found that the interests of the public and users of the surface and ground waters would be served by an adjudication and determination of the relative rights of all claimants to the use of these waters. /3

Pursuant to the State Water Code, Donald W. Moos, Director of Ecology, appointed William R. Smith as referee to take testimony and report his recommendations to the Superior Court. /4 The referee subsequently directed Ecology to evaluate and report on all claims filed in connection with the general adjudication. /5

After Ecology completed and filed with the referee reports of investigations on all claims, /6 the referee held a hearing to take testimony from each claimant. /7 Appellants Clarence E. and Peggy V. Grimes appeared and provided testimony on each of their claims. /8

The Grimeses submitted five claims for water rights, only the first of which is at issue in this appeal. This claim was for the use of waters for domestic supply, irrigation and

(Footnote cont'd. from previous page) filed a brief as respondents. Only Appellants Clarence E. and Peggy V. Grimes seek review before this court.

3 Supplemental Clerk's Papers vol. 1, at 3-4.

4 Supplemental Clerk's Papers vol. 1, at 60. See RCW 90.03.160; RCW 90.03.190.

5 Supplemental Clerk's Papers vol. 2, at 18-19.

6 Plaintiff's exhibit, at 4.

7 Supplemental Clerk's Papers vol. 2, at 27-29.

8 Supplemental Clerk's Papers vol. 2, at 164-213.

recreational purposes. The Grimeses requested an instantaneous flow rate of 3 cubic feet per second (c.f.s.) for irrigation purposes, and a storage right of 1,520 acre feet of water in the Marshall Lake reservoir. The referee recommended that this claim be confirmed, but limited it to an instantaneous flow of 1.5 c.f.s. during irrigation season, and a storage right of 183 acre feet plus 737 acre feet for evaporative loss, for a total storage right of 920 acre feet.

The four additional claims of the Grimeses were for various uses of the water of Marshall Lake. The referee recommended confirmation of the second, fourth and fifth claims, /9 and did not recommend confirmation of the third claim. /10 The determinations on these claims are not at issue here.

Pursuant to the statute, the Grimeses filed exceptions to the report of the referee in the superior court. /11 On May 19, 1988, the Honorable Fred L. Stewart, Pend Oreille County Superior Court,

entered an order which denied their exceptions in part, and remanded the matter to the referee to take further evidence on the Grimeses' exceptions relating to (1) the right to store 183 acre feet of water and the period of storage in Marshall Lake; and (2) the establishment of a minimum level of Marshall Lake for measuring waters to be stored under the Grimeses' storage right. /12

After a hearing on remand, the referee issued a "Report of Referee Pursuant to Order on Exceptions of May 19, 1988." /13 The Grimeses again filed exceptions, objecting to the referee's determination that, in measuring their storage right, the minimum or natural level of Marshall Lake is 2,720 feet above sea level. /14

9 Clerk's Papers, at 295-96, 297.

10 Clerk's Papers, at 296, 297-98.

11 Clerk's Papers, at 317-23.

12 Clerk's Papers, at 337-39.

13 Clerk's Papers, at 341-455.

14 Clerk's Papers, at 456-58.

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On January 5, 1990, after hearing testimony on the Grimeses' exceptions, the Superior Court entered its "Decree Adjudicating Water Rights Pursuant to RCW 90.03.200." /15 The decree approved the "Report of Referee", as amended by the "Report of Referee Pursuant to Order on Exceptions of May 19, 1988." Based upon stipulations between the parties, the decree stated that the natural level of Marshall Lake, for the purposes of a measurement of the storage right, is 2,722.62 feet above mean sea level, rather than 2,720 as recommended by the referee. /16

On February 2, 1990, Clarence E. and Peggy V. Grimes filed a notice of appeal in the Court of Appeals, Division Three. /17 The Coalition of Yakima River Basin Irrigators, a group of 35 Eastern Washington irrigation districts, was authorized to participate as amicus curiae. On December 26, 1991, the Court of Appeals, Division Three, issued an order of certification which was filed in the Supreme Court on January 14, 1992. In its order of certification, the Court of Appeals stated that "[t]he decision of this [case] is of broad public import as it will impact at least 35 irrigation districts, water companies and municipalities who in turn represent thousands of water users in the Yakima River basin." On January 24, 1992, a ruling accepting certification was issued by this court.

STANDARD OF REVIEW

[1] Appellate review of a decree in a general adjudication of water rights is to be made in the same manner as in other cases in equity. /18 Since January 2, 1951, there has been no distinction in this court in the method of review between equity and law cases. /19

15 Clerk's Papers, at 459-61.

16 Clerk's Papers, at 459-61. Because of the stipulation, this determination is not in issue.

17 Clerk's Papers, at 462.

18 RCW 90.03.200.

19 Haire v. Patterson, 63 Wn.2d 282, 286, 386 P.2d 953 (1963).

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[2, 3] The appellants challenge the consideration of evidence by the referee and the trial court, as well as application of the law relating to appropriative water rights. This court will defer to findings of fact, as determined by the referee and confirmed by the trial court, if they are supported by substantial evidence. /20 However, the test employed by the referee and confirmed by the trial court in determining beneficial use, including the identity and weight of factors used in the test, is a question of law. Questions of law are reviewed de novo by this court. /21

GENERAL ADJUDICATION

[4, 5] A general adjudication is a special form of quiet title action to determine all existing rights to the use of water from a specific body of water. /22 In Washington, the adjudication procedure is set forth in RCW 90.03.110 et seq. The provisions for adjudication in the Water Code, RCW 90.03-.110-.245, may not be used to lessen, enlarge or modify existing water rights. /23 An adjudication of water rights is only for the purpose of determining and confirming those rights. /24 The surface water rights of the Grimeses in this case are pre-1917 rights, established 11 years before adoption of the Water Code of 1917 and 65 years before adoption of the Water Resources Act of 1971. Subsequent amendments to the 1917 Water Code have clearly stated that nothing in the act "shall affect or operate to impair any existing water rights." /25 To confirm existing rights, the referee must

20 See Haire, at 282.

21 Franklin Cy. Sheriff's Office v. Sellers, 97 Wn.2d 317, 325, 646 P.2d 113 (1982), cert. denied, 459 U.S. 1106, 74 L. Ed. 2d 954, 103 S. Ct. 730 (1983).

22 McLeary v. Department of Game, 91 Wn.2d 647, 591 P.2d 778 (1979).

23 RCW 90.03.010.

24 RCW 90.03.245.

25 RCW 90.54.920; see Laws of 1989, ch. 348, SS 2 (RCW 90.03.005); see also Laws of 1979, 1st Ex. Sess., ch. 216, SS 8.

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determine two primary elements of a water right: (1) the amount of water that has been put to beneficial use and (2) the priority of water rights relative to each other. /26

Appellants contend that they or their predecessors in interest have owned and continuously used all waters of Marshall Lake since 1906, and that the State has no authority to limit, control, or regulate their impoundment rights or the quantity of their use of those waters. /27 A general adjudication, however, is intended to determine all rights to the use of a body of water, whether riparian or appropriative, and whenever acquired. /28 The State therefore must include the Grimeses' water rights in this adjudication.

THE DOCTRINE OF PRIOR APPROPRIATION /29

[6] The law of prior appropriation was established in this state by the Territorial Legislature in 1873³⁰ and recognized by this court in 1897. /30 This court in *Neubert v. Yakima-Tieton Irrig. Dist.* /31 said that "[t]he appropriated water right is perpetual and operates to the exclusion of subsequent claimants." In that case we said appropriative water rights require that:

Once appropriated, the right to use a given quantity of water becomes appurtenant to the land. The appropriated water right is perpetual and operates to the exclusion of subsequent claimants.

26 See *Department of Ecology v. Acquavella*, 100 Wn.2d 651, 674 P.2d 160 (1983).

27 Brief of Appellants, at 19-27.

28 *Department of Ecology v. Abbott*, 103 Wn.2d 686, 692, 694 P.2d 1071 (1985).

29 The Grimeses argue that they are entitled to their claimed water rights on the basis of their riparian ownership. Each of their original claims, however, was based on appropriation law. Because of this, we need not decide whether riparian rights to Marshall Lake have been eliminated because of its artificial elevation. See *Clippinger v. Birge*, 14 Wn. App. 976, 984, 547 P.2d 871 (1976).

30 Laws of 1873, p. 520, SS 1.

31 *Benton v. Johncox*, 17 Wash. 277, 49 P. 495 (1897).

32 117 Wn.2d 232, 237, 814 P.2d 199 (1991).

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The key to determining the extent of plaintiffs' vested water rights is the concept of "beneficial use". . . . An appropriated water right is established and maintained by the purposeful application of a given quantity of water to a beneficial use upon the land. / [33]

Beneficial use refers to the quantity of water diverted by the appropriator, not to its availability in the source of supply. /34 "The underlying reason for all this constitutional, legislative and judicial emphasis on beneficial use of water lies in the relation of available water resources to the ever-increasing demands made upon them." /35

[7] "Beneficial use" is a term of art in water law, and encompasses two principal elements of a water right.

First, it refers to the purposes, or type of activities, for which water may be used. Use of water for the purposes of irrigated agriculture is a beneficial use. /36 The Grimeses' use of water to irrigate alfalfa fields is not at issue in this case.

Second, beneficial use determines the measure of a water right. The owner of a water right is entitled to the amount of water necessary for the purpose to which it has been put, provided that purpose constitutes a beneficial use. /37 To determine the amount of water necessary for a beneficial use, courts have developed the principle of "reasonable use". Reasonable use of water is determined by analysis of the factors of water duty and waste. /38

In his findings establishing the measure of the Grimeses' water right, the referee stated that:

[A] valid right for irrigation purposes only exists for the benefit of these claimants and such right is derived from the original

33 (Citations omitted.) Neubert, at 237.

34 1 Waters and Water Rights SS 19.2, at 85 (R. Clark ed. 1967).

35 Waters and Water Rights, at 87.

36 RCW 90.54.020.

37 Waters and Water Rights, at 86-87.

38 United States v. Alpine Land & Reservoir Co., 697 F.2d 851, 854 (9th Cir. 1983).

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1906 Linsley notice. It is, therefore, recommended that a right be confirmed to these defendants, with a July 13, 1906 priority for the irrigation of 73 acres from Marshall Lake. Quantification of the amount of water to which this right is entitled creates somewhat of a

problem in that there has been no direct testimony regarding the amount of water placed to beneficial use other than a reference in the state's investigatory report that 56 sprinklers are utilized in the system. . . . Therefore, the Referee will allow the standard duty of water which would be 1.2 cubic feet per second plus an additional 25 percent for transportation loss, thus making an aggregate amount of 1.5 cubic feet per second identified with this right. . . .

A second element concerning this right is the amount of storage of water to which these claimants are entitled. . . . [T]hese waters also have recreational benefits, not only to the riparian owners around the lake but also to the general public through the use of resort facilities located on the lake. . . . Therefore, the Referee recommends that a related but separate right be confirmed to these defendants for the storage of 920 acre-feet in Marshall Lake for irrigation and recreation purposes. The priority shall be fixed as of July 13, 1906. The period during which waters may be stored shall be identified as those periods of the year which do not include the April 1 to October 31 irrigation season. /{39]

The Grimeses challenge the referee's "consideration of the evidence" and his application of the law in making these findings. We first consider the evidence used by the referee in establishing the factors of water duty and waste. We then consider the test of "reasonable efficiency" employed by the referee, and adopted by the Superior Court, to evaluate these factors.

WATER DUTY

[8] "[Water duty] that measure of water, which, by careful management and use, without wastage, is reasonably required to be applied to any given tract of land for such period of time as may be adequate to produce therefrom a maximum amount of such crops as ordinarily are grown thereon. It is not a hard and fast unit of measurement, but is variable according to conditions." /40

39 Report of Referee; Clerk's Papers, at 293-95.

40 *In re Steffens*, 756 P.2d 1002, 1005-06 (Colo. 1988) (quoting *Farmers Highline Canal & Reservoir Co. v. Golden*, 129 Colo. 575, 272 P.2d 629 (1954)); see *In re Ahtanum Creek*, 139 Wash. 84, 96, 245 P. 758 (1926).

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The referee based his determination of the volume of water necessary for irrigation in the Marshall Lake basin on a Washington State University Research Bulletin entitled "Irrigation Requirements for Washington - Estimates and Methodology" (Irrigation Report), and on the expert testimony of Jim Lyerla, the District Supervisor for seven Eastern Washington counties, including Pend Oreille County, in the Water Resources Program of the Department of Ecology. Mr. Lyerla testified that as a part of his work in assigning water quantities to new water permittees, he relied on the Irrigation Report to determine the "water duty" for a proposed use of water. The Irrigation Report provides information for water requirements for specific crops, given in inches per acre per irrigation season, in 40 locations around the state, including Newport, Washington, 5 miles south of Marshall Lake.

Based on the testimony of Mr. Lyerla and the Irrigation Report, the referee determined that an irrigated alfalfa crop grown in the Marshall Lake area requires 21 inches or 1.75 acre feet of water per acre during the irrigation season. The referee then applied an efficiency factor and increased this water duty to 2.5 acre feet per acre per year. The referee found this water duty to be "approximately commensurate with the duty utilized by the Department of Ecology in its quantity allocations in this geographic area under the water right permit system." /41

Because water rights are characterized in both total yearly allowance and instantaneous flow, the referee also established the maximum rate of diversion at 0.0166 c.f.s. per acre under irrigation. The referee first calculated a standard flow of 1 c.f.s. of water per 60 acres as a reasonable instantaneous flow for alfalfa irrigation in the Marshall Lake basin. /42 In considering the Grimeses' claim, he determined that the Grimeses were entitled to sufficient flow to irrigate 73 acres, or a minimum of 1.21 c.f.s. He then calculated in an efficiency

41 Report of Referee; Clerk's Papers, at 275.

42 The record does not indicate the foundation for this calculation.

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factor to increase this flow by 25 percent and awarded the Grimeses an instantaneous flow of 1.5 c.f.s. The referee observed that a larger water duty could be awarded to any claimant with specific information proving a right to a larger amount. The 2.5 acre feet/0.0166 c.f.s. water duty was applied when "quantitative evidence of the rate and volume of a right was neither submitted nor made clear during testimony." /43 The referee also observed that "the use of water under all irrigation rights is, however, limited to the amount of water that can be beneficially applied to that number of acres identified in the water right." /44 The referee did not indiscriminately award this water duty to any claim for an irrigation right, but required claimants to prove the number of acres historically irrigated.

[9] In water rights adjudications, the establishment of a water duty must not be disturbed in "the absence of very conclusive evidence contrary to the . . . adjudication, showing arbitrariness on [the] part [of the adjudicator] . . ." /45 The referee's determination of a generic water duty for irrigation of alfalfa in the Marshall Lake basin is supported by a preponderance of the evidence and will not be disturbed by this court. /46

WASTE

[10] From an early date, courts announced the rule that no appropriation of water was valid where the water simply went to waste. Those courts held that the appropriator who diverted more than was needed for the appropriator's actual requirements and allowed the excess to go to waste acquired no right to the excess. /47 A particular use must not only be of

43 Report of Referee; Clerk's Papers, at 275.

44 Report of Referee; Clerk's Papers, at 274.

45 In re Ahtanum Creek, 139 Wash. 84, 96, 245 P. 758 (1926).

46 In re Ahtanum Creek, at 97.

47 Budd v. Bishop, 543 P.2d 368, 373 (Wyo. 1975); State ex rel. Erickson v. McLean, 62 N.M. 264, 270, 308 P.2d 983, 987 (1957); Thorp v. McBride, 75 Wash. 466, (Footnote cont'd. next page)

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benefit to the appropriator, but it must also be a reasonable and economical use of the water in view of other present and future demands upon the source of supply. /48 The difference between absolute waste and economical use has been said to be one of degree only. /49

Appellant Clarence E. Grimes acknowledged in his testimony that his existing irrigation system required a water flow of up to 3 cubic feet per second in order to deliver 1 cubic foot per second to the field, /50 and that this system was highly inefficient, causing one-half to two-thirds loss of water. /51 Mr. Grimes also testified that uncertainties and ongoing litigation concerning the stability and safety of the irrigation dam had prevented continuous irrigation of his alfalfa acreage. /52 Other claimants testified concerning their use of the water claimed. /53

While an appropriator's use of water must be reasonably efficient, absolute efficiency is not required. /54 The referee determined that, pursuant to RCW 90.14.160, the uncertainties concerning the irrigation dam constituted sufficient cause not to find a complete abandonment of the Grimeses' water right. He resolved the conflicting testimony by limiting the irrigable acreage to the 73 acres recommended by Ecology. Relying on a standard efficiency factor for irrigation

(Footnote cont'd. from previous page) 135 P. 228 (1913). See also Trelease, The Concept of Reasonable Beneficial Use in the Law of Surface Streams, 12 Wyo. L.J. 1, 16 (1957) (citing Power v. Switzer, 21 Mont. 523, 55 P. 32 (1898)).

48 12 Wyo. L.J. at 16.

49 In re Water Rights of Deschutes River, 134 Or. 623, 286 P. 563, 294 P. 1049 (1930).

50 Clerk's Papers, at 208, 234.

51 Clerk's Papers, at 108, 208.

52 Clerk's Papers, at 221.

53 Clerk's Papers, at 167-200.

54 Waters and Water Rights, at 87 (citing Allen v. Petrick, 69 Mont. 373, 376, 380, 222 P.

451 (1924)).

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sprinkler systems found in the Irrigation Report, he confirmed in the Grimeses a water right with one-fourth conveyance loss for a total of 1.5 cubic feet per second. /55 There was at least sufficient evidence for the referee to determine the maximum acreage to which the Grimeses' water right applied, and in limiting the allowable loss for system inefficiency in establishing their instantaneous flow.

THE REASONABLE EFFICIENCY TEST

In limiting the Grimeses' vested water right, the referee balanced several factors, including the water duty for the geographical area and crop under irrigation, the claimants' actual diversion, and sound irrigation practices. In his report, the referee described his method of calculating the Grimeses' water right as a "reasonable efficiency" test. /56

Amici curiae argue that this test is contrary to judicial decisions which have recognized that the standard of reasonable beneficial use of water for irrigation is limited to consideration of the use of the established means of diversion and application according to the reasonable custom of the locality. /57 Respondent Ecology argues that the 3-part "reasonable efficiency" test cited by the referee provides "the balance sought by the courts between the competing needs of efficiency and maximum utilization of the water, and the existing physical and economic limitations in each situation." /58 Ecology asserts that local custom in irrigation practices is but one of several factors the court must consider in deciding whether a given use of water is reasonable, and, therefore, beneficial.

While the referee stated that he relied on this test, and while he did in fact consider some of its elements, he did not actually utilize the test in its entirety. Therefore, we will

55 Clerk's Papers, at 102.

56 Report of Referee Pursuant to Order on Exceptions of May 19, 1988, n.1; Clerk's Papers, at 343.

57 Brief of Amici Curiae, at 2.

58 Brief of Respondent, at 21.

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review the factors he did consider to determine whether his analysis remained within the boundaries of prior appropriation law. In his discussion of the basis for his recommendation concerning the Grimeses' claim, the referee stated that he would "balance [the water duty] against not only the actual amount of

water diverted from the lake for irrigation purposes but also against the concepts of beneficial use of water and sound irrigation practices." /59

Amici curiae urge this court to hold that only "the established means of diversion and application according to the reasonable custom of the locality" may be considered in defining reasonable use. /60 This argument is based on the eminent domain provision of the State Water Code, which prohibits condemnation of a water right when the owner of that right is using the water:

for the irrigation of his land then under irrigation to the full extent of the soil, by the most economical method of artificial irrigation applicable to such land according to the usual methods of artificial irrigation employed in the vicinity where such land is situated. In any case, the court shall determine what is the most economical method of irrigation. /61

[11] This court has consistently held that rights of users of water for irrigation purposes are vested rights in real property. /62 Amici curiae assert that the "local custom" test has been employed historically to determine whether given applications of water are wasteful, within the meaning of beneficial use, and that courts should now apply it in the setting of general adjudications. This is the established law in this state. /63

59 Report of Referee; Clerk's Papers, at 294.

60 Brief of Amici Curiae, at 2-3.

61 RCW 90.03.040.

62 *Neubert v. Yakima-Tieton Irrig. Dist.*, supra at 236-37; *Foster v. Sunnyside Vly. Irrig. Dist.*, 102 Wn.2d 395, 400, 687 P.2d 841 (1984); *Department of Ecology v. Acquavella*, supra at 656.

63 *Department of Ecology v. Acquavella*, supra at 656.

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Decisions of courts throughout the western states provide a basis for defining "reasonable efficiency" with respect to irrigation practices. /64 While customary irrigation practices common to the locality are a factor for consideration, they do not justify waste of water. /65 As this court stated in a case predating the Water Code of 1917:

[W]hen rights in such an important element as water is in the arid regions are to be measured by the courts, we cannot lay down a rule that would give to the user an arbitrary right to use water at will. [An irrigator's] rights are to be measured by his necessities . . . and not by any fanciful notion of his own. . . .

. . . [C]ustom can fix the manner of use of water for irrigation only when it is founded on necessity . . . [and] an irrigator is entitled to use only so much as he can put to a beneficial

use, for the public policy of the people of the United States will not tolerate waste of water in the arid regions. /66]

Local custom and the relative efficiency of irrigation systems in common use are important elements, but must be considered in connection with other statutorily mandated factors, such as the costs and benefits of improvements to irrigation systems, including the use of public and private funds to facilitate improvements. /67

[12] In limiting the Grimeses' water use by a requirement of reasonable efficiency, the referee properly considered the Irrigation Report, the Grimeses' actual water use, and their existing irrigation system. The referee alluded to a test incorporating factors that consider impacts to the water source and its flora and fauna. /68 While consideration of these impacts is consonant with the State's obligations under RCW

64 Tulare Irrig. Dist. v. Lindsay-Strathmore Irrig. Dist., 3 Cal. 2d 489, 546-47, 45 P.2d 972, 997 (1935); Hardy v. Beaver Cy. Irr. Co., 65 Utah 28, 40-41, 234 P. 524, 529 (1924).

65 Tulare, at 546-47.

66 Shafford v. White Bluffs Land & Irrig. Co., 63 Wash. 10, 13-16, 114 P. 883 (1911).

67 RCW 90.03.005.

68 Report of Referee; Clerk's Papers, at 254.

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90.03.005 and 90.54.010(1)(a) and (2), these factors cannot operate to impair existing water rights. Other laws may, however, operate to define existing rights in light of environmental values. /69

There is some confusion in the record as to the legal standard used by the referee in determining beneficial use. In his original report, the referee discussed determination of water duty. His proposed volume and rates of water were based upon exhibit 5 and expert testimony, when quantitative evidence of the rate and volume of a right was neither submitted nor made clear during testimony. /70 There is no discussion in the original report of any "reasonable efficiency" test.

However, the referee rendered a supplemental report in response to exceptions taken by the Grimeses. In it he considered a storage right and made it clear that that right should not be confused with the diversion right of 1.5 c.f.s. But in a footnote the referee set forth a detailed "test of reasonable efficiency" which he purportedly used in determining beneficial use. That "test" is stated as follows:

(1) [C]ustomary delivery and application practices in the area, (2) technology and "practices" improvements feasible and available to reduce water consumptions and financial needs associated with implementation thereof, and (3) impacts of improvements of existing facilities and practices, if initiated, upon (a) the water source from which the diversion takes place, (b) the existing flora and fauna within the area of diversion, conveyancy and actual uses, (c) other water rights from said water source, and (d) other water users on other water sources. /71]

There is nothing in the record to support the referee's statement that he employed the reasonable efficiency test. Nowhere in the record does he discuss application of the elements of the so-called "test". If he had in fact applied the "test", it would be necessary for this court to reverse and remand. That test is without statutory authorization in an

69 See RCW 90.03.005; RCW 90.03.010.

70 Clerk's Papers, at 275.

71 Clerk's Papers, at 343 n.1.

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adjudication proceeding which relates exclusively to confirmation of water rights established or created under "other provisions of state law or under federal laws." /72

[13, 14] Adjudication proceedings cannot be used "to lessen, enlarge, or modify the existing rights of any riparian owner, or any existing right acquired by appropriation, or otherwise." /73 The suggested test would be contrary to the vested rights of water users. "It has long been settled in this state that property owners have a vested interest in their water rights to the extent that the water is beneficially used on the land." /74 Included in the vested rights is the right to diversion, delivery and application "according to the usual methods of artificial irrigation employed in the vicinity where such land is situated." /75 The Legislature sets a standard clearly contradictory to the suggested test in RCW 90.03.040, which relates to eminent domain over water rights. The test is contrary also to long established principles of Western water law. /76

While we reject use of the specific test suggested by the referee, we affirm because (1) there is no indication in the record that he in fact applied the factors stated in the "test", and (2) he applied the actual beneficial use made by Grimes, taking into account the actual needs and use and the methods of delivery and application in the vicinity. The adjudication and confirmation of a water right in an amount less than claimed by Grimes does not result from application of the so-called test. Rather, as the referee makes clear:

Quantification of the amount of water to which this right is entitled creates somewhat of a problem in that there has been no direct testimony regarding the amount of water placed to

72 RCW 90.03.245.

73 RCW 90.03.010.

74 Department of Ecology v. Acquavella, 100 Wn.2d 651, 655, 674 P.2d 160 (1983).

75 RCW 90.03.040.

76 Tulare Irrig. Dist. v. Lindsay-Strathmore Irrig. Dist., 3 Cal. 2d 489, 45 P.2d 972 (1935); State ex rel. Crowley v. District Court, 108 Mont. 89, 88 P.2d 23 (1939); Hardy v. Beaver Cy. Irr. Co., 65 Utah 28, 234 P. 524 (1924).

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beneficial use other than a reference in the state's investigatory report that 56 sprinklers are utilized in the system. /77]

In the absence of such proof, the referee nevertheless confirmed the right by using a normal duty of water for the type of crops raised and specifically added 25 percent for transportation loss. Making the best of inadequate proof by the claimant, it appears from the record that the referee applied the usual methods of irrigation employed in the vicinity where the Grimeses' land is located.

THE TAKINGS ARGUMENT

[15] Appellants Grimes argue that diminishment of their prior appropriation in any way is a "taking" of their property right for which they must be compensated or have the decision of the trial court set aside. /78 A vested water right is a type of private property that is subject to the Fifth Amendment prohibition on takings without just compensation. /79 Nevertheless, the concept of "beneficial use", as developed in the common law and as described earlier in this opinion, operates as a permissible limitation on water rights. /80

RCW 90.14.160 provides for relinquishment of unused water rights. The statute provides that:

Any person entitled to divert or withdraw waters of the state through any appropriation authorized by enactments of the legislature prior to enactment of chapter 117, Laws of 1917, or by custom, or by general adjudication, who abandons the same, or who voluntarily fails, without sufficient cause, to beneficially use all or any part of said right to divert or withdraw for any period of five successive years after the effective date of this act, shall relinquish such right or portion thereof, and said right or portion thereof shall revert to the state, and the waters affected by said right shall become available for appropriation in accordance with RCW 90.03.250. /81]

77 Clerk's Papers, at 293.

78 Brief of Appellants, at 28.

79 Department of Ecology v. Adsit, 103 Wn.2d 698, 705, 694 P.2d 1065 (1985).

80 Budd v. Bishop, 543 P.2d 368, 373 (Wyo. 1975).

81 RCW 90.03.250 prescribes the procedure for water appropriation applications.

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Pursuant to RCW 90.14.160, Appellants Grimes were entitled to "divert or withdraw" the subject water. However, the referee's finding, which we will not disturb, that their voluntary failure, "without sufficient cause", to beneficially use all of the waters diverted requires that those waters "revert to the state . . . and . . . become available for appropriation". The Grimeses' claim that their water right has been partially "taken" without just compensation necessarily fails.

CONCLUSION

Although we agree with the conclusion reached by the referee in this case, we expressly reject the test he purportedly used.

Applying the concepts of "beneficial use" to water rights in this state, we rule on the merits and affirm the decision of the Pend Oreille County Superior Court, dated January 5, 1990, which substantially approved the conclusion of the referee relating to the water rights of Appellants Clarence E. and Peggy V. Grimes.

ANDERSEN, C.J., and UTTER, BRACHTENBACH, DOLLIVER, DURHAM, GUY, and JOHNSON, JJ., concur.