ROZA
IRRIGATION DISTRICT

To: Board of Directors

From: Scott Revell, District Manager

Date: February 11, 2025

Re: Yakima River Water Stargrass Control Overview

Background

Water stargrass is a native plant in the Yakima River which has taken over the lower 50+ miles of the river and is choking out much of the other aquatic life.

Stargrass is now so prolific that it causes the dissolved oxygen level to drop at night when the plants are not photo synthesizing and expressing oxygen. The dissolved oxygen level bottoms out just before dawn, and in the summer of 2024 up migrating adult sockeye could not breathe and died in large numbers in the lower Yakima River.

Stargrass also slows the water flow, which increases water temperatures and provides cover to predators which have been contributing to increasing juvenile smolt mortality to unprecedented levels. Some estimates are that smolt mortality may exceed 90% in some years, partly attributable to stargrass proliferation.

Irrigation entities with proratable water supplies, which are already reduced during drought years, could be impacted disproportionally in 2025 and beyond because of the extent of the stargrass problem and its effect on fish.

There is no single agency in charge of controlling water stargrass. Irrigation districts, state agencies, the Yakama Nation and multiple federal agencies all have some role in its management or control. The Benton Conservation District has led the effort in recent years.

Overall, the desire to take urgent immediate action must be tempered with a methodical review of potential unintended consequences. Controlling stargrass will take an ongoing long term combined effort which involves multiple strategies by multiple levels of government.

These strategies do not have easy funding mechanisms in place and creativity will be at a premium.

The overall approach is to divide the river into segments and customize a control strategy for each segment, because each river segment has different diversions, pump intakes, return flow points, access points and flow characteristics. Some reaches of the river are more suited for mechanically harvesting stargrass than others.

Stargrass Basics

While the most serious problems are from the Mabton area downstream, water stargrass is now found as far upstream as Roza Dam. It is very unusual for a native aquatic plant to proliferate so broadly and rapidly. In addition to stargrass, elodea and algae are also present.

- ✓ Stargrass begins growing when the water is 46 degrees (late March/early April) and stops growing in the fall when the water temperature is below 50 degrees (late Oct./early Nov.).
- ✓ Herbicide treatments when the water temperature is above 60 degrees (late May) are the most effective.
- ✓ The rhizomes reside below the surface of the river bed in the silt.
- ✓ Water stargrass spreads from seeds dispersed by water and from rooted stem fragments according to some research (and may be spread from any plant fragments-this issue is being researched further).
- ✓ Water stargrass is also a food source for waterfowl.
- ✓ Stargrass has a silica content that makes it unfeasible as animal forage.
- ✓ Yakima River stargrass was tested in a laboratory for heavy metals which were not detected.
- ✓ Massive stargrass mats break off in the early fall when flows increase and the water level rises which clog irrigation intakes. It is not yet clear if this changes the dissolved oxygen problem in certain locations. Mat breakoff may be tied to water temperature.

Stargrass Management Strategies

The most effective approach is removal of the plant material at the roots. Removal by hand takes a tremendous amount of time, and optimizing the cycle times is key to making real progress on stargrass control. An HPA permit from WDWF is required to harvest stargrass.

Cutting material is similar to mowing it and regrowth occurs within several weeks, although usually at a much lower density. Much of the stargrass needs to be cut two times per harvest cycle. More information is need to ensure that removal by the root is not inadvertently making the problem worse by spreading it through rooted stem fragments.

There is evidence that harvesting modestly improves the level of dissolved oxygen in the area immediately downstream of the harvest area.

- **Hand pulling**-Works well but is very labor intensive, and can only occur in the areas that can be waded. Dozens of volunteers have cleared certain spots for more than ten years which lasts for two to three years. This effort would need to ramped up by a factor of more than 100 to make a meaningful improvement.

- **Current Mechanical Harvesting Operations**- Began in 2021 using a mid-sized machine that has paddles and a propeller for propulsion. Roughly 16 acres were cleared in 2024.

  Mechanical harvesting is governed by a Hydraulics Project Authorization (HPA) issued by the State Department of Fish and Wildlife and is limited to July 1 to August 31. Extensions to September 15 were approved in 2023 and 2024.

  The Yakima River Delta area in the McNary pool of the Columbia River, the Wanawish pool and the Prosser pool have been the focus of mechanical harvesting. The total area harvested is very small, but could be increased significantly with more resources. The pictures below are merely to illustrate the technology and are not an endorsement or preference for any brand or model.

The harvester used currently reaches to a depth of about 3 feet and has a bunk capacity of about 3 cubic yards. It is used with the roller head as depicted in the picture. The machine also has a sickle cutting head option. A GPS unit maps its track as it traverses the river. The machine cost roughly $125,000 to purchase in 2021 and costs $50,000 to operate and maintain annually for the 60-to-75-day harvest season.

  Taking harvested stargrass to the shore consumes a great deal of time. That function could be optimized. Cutting the plants and allowing the material to drift downstream would greatly improve efficiency. Cutting and drifting has been allowed by DFW in the Prosser pool on a trial basis, but it may not always be possible in each reach of the river. DFW recognizes that stargrass already proliferates through nearly all of the lower 50 miles of the river.

  We are seeking information about the effects of large amounts of decaying stargrass cuttings negatively affecting dissolved oxygen levels downstream. This can occur in closed lakes and ponds which do not have a continual inflow of water and oxygen as would occur in a river system.

- **Future Expansion & Optimization of Mechanical Harvesting**

  ✓ Several more harvesters and different harvesters could be purchased, although people are then needed to operate and maintain them.

  ✓ Larger shallow draft (under 2 feet) harvesters are being examined. There are boat launches in each pool that appear to be accessible with a marinized 35-foot double axel over deck trailer.

Larger boat harvesters with more bunk capacity (up to 20 cubic yards) and a conveyor to reduce the offload cycle time. These harvesters are roughly $350,000 with tax, but without shipping.

The machines can be trailered and can be towed with a heavy-duty pickup. These machines can only be used above dams in slow moving pools or in the delta.

There are also amphibious harvesters with tracks, which also allows the machine to be unloaded and then launched into the water which may works well in some of the shallower areas. These machines cost roughly $450,000 with tax and shipping. Smaller less expensive machines are available with reduced capacities.

  ✓ Smaller harvesters which look like a floating skid steer, and can be equipped with a bucket or a root rake, are also being examined.

These machines are also shallow draft and would be optimized with tender boat(s), potentially equipped with a conveyor to reduce offload cycle times. These machines are roughly $125,000 each with tax and shipping (and a trailer). These machines can reach down 3 to 4 feet. They may work in the areas that have not yet been addressed. More launch access points are needed.

- ✓ Long stick amphibious excavators with 60-foot booms:

With the right rake attachments they may be able to make significant headway in the shallower reaches of the river or from the shore in places.

Costs are being researched, and will be at least several hundred thousand dollars each. These machines may also work in the pools.

Twin Falls Canal company in Idaho uses excavators with custom fabricated large rake attachments (8+ feet in length) to remove weeds from their canals which look to be promising. We have also investigated these types of rakes. They do not work well in rocky river bottoms, but it may be possible to modify them to perform better.

- ✓ With sufficient staffing resources, it may be possible to run two shifts a day with any of the machines to maximize productivity during the 60 to 75 day +/- in-river work window. Costs will increase commensurately.

  Even with more machines and optimized operations it may not be possible to cut enough stargrass fast enough to make the dissolved oxygen problem worse than the existing condition, if the material decays within two weeks.

- ✓ When a lane is cleared with the harvester, all other floating material in the river tends to flow down that lane, which can cause problems at downstream irrigation diversions.

- ✓ Tender barges could be employed to reduce transit time by the machines. One harvester manufacturer explained that some aquatic weed removal operations use older party barges as tenders after cutting the furniture out and adding a deck because they can be obtained very inexpensively.

Stargrass piled on the riverbank and disintegrating in 2023

Aquatic Herbicides-Roza staff have been discussing options with several chemical manufacturer's representatives to better understand the products which can be both effective on stargrass and safe for fish, and also do not cause problems when the water is used for irrigating crops, livestock and recreationalists downstream. Treatments are most effective when the water temperature is 60 degrees or above and the plant is flowering, which usually occurs from late May through late September.

- ✓ Canal treatments occur in locations where there is good mixing, such as downstream of a dam or at a major return flow point. If the objective is to create a migration lane for fish in the river channel, less mixing would be beneficial in order to keep the chemical contained.

- ✓ For comparison, Roza typically treats the Main Canal with Endothall two times per year when the canal is flowing at 600 to 700 cfs at 4 parts per million at a cost of $105,000 +/- per treatment at 2024 prices. Roza treats 80+ miles of Main Canal with each endothall treatment. The maximum label rate is 5 parts per million, which would cost roughly $130,000 for each treatment. Endothall takes two to three weeks to begin seeing the effects on the plants.

  Higher spring flows in April could significantly increase the amount of herbicide needed (2x to 3x) and the costs would increase commensurately.

  During drought years, when the prorationing date is in April or early May would likely have lower flows in the lower river and would make herbicide treatments more economically viable.

- ✓ Large amounts of algae can prevent the herbicide from making it into the stargrass and reducing the effectiveness. This had been a problem in Columbia Basin Project canals at times.

- ✓ We have found an irrigation district in Idaho that has used endothall to treat stargrass in a river. Treatments occurred under Idaho's laws, which are different than Washington's laws.

- ✓ Aquatic herbicide treatments in the river are governed by an Aquatic Plant and Algae General Permit (APAM) which is administered by the Department of Ecology. The permit involves a 30 day public notice requirement among many other provisions.

- ✓ Treating the river would likely require two to three treatments per year. A spring treatment when the stargrass is younger and growing would be the time to start the program. It may be possible to treat the dense matted areas with a drone using Diquat or crystallized endothall.

- ✓ Close coordination with other major diverters and USBR will be needed to keep the river at steady flows in the sections being treated to avoid diluting the treatments and reducing their effectiveness.

- ✓ A summer herbicide treatment, if not proceeded by a spring treatment, would allow full plant growth to occur and would increase the amount of decaying plant material. Returning adult sockeye would be subject to the same low oxygen levels in July.

In the Roza canal system, when one type of plant is controlled another often begins to takes its place. An example is controlling sago pondweed, which often leads to more horned pondweed, which in turn is even harder to control.

There are dozens of private irrigation intakes in the lower river whose owners would need to be notified of treatments. Dipotassium salt of endothall (known as Cascade), which is systemic and is one of several options, does not have FIFRA label restrictions after treatment for swimmers, anglers, livestock, wildlife, but does for potable water diversions (which are being researched).

There are likely special interest groups who do not share the urgency that the irrigation districts, Yakama Nation and the state and federal fishery managers have expressed to address the stargrass problem.

- **Ultrasonic treatments-** These treatments are done in large ponds in places and are also being examined for applicability in the Yakima River. Costs, effectiveness and environmental impacts are not yet known.

- **Ultra Violet Lights-** Boat mounted UV-C light arrays are also being examined. A similar system is used in Lake Tahoe to good effect in places treated twice per year. Exposure time is 15-20 minutes and go to a depth of around 20 feet, which complicates use in a river system, but may work in certain spots. The costs are not yet known.

  It may be possible to use UV light to treat a channel in a pool one season and then move to the next pool the following season.

  Effects on fish are not yet known, which means that the treatment work window is not yet known and could be limited to certain summer months when salmon are not present due to high water temperatures.

- **Dye Treatments**-Nontoxic dye may be able to be used to cloud the water in order to reduce plant growth, which would also provide some protection for out-migrating smolt. Doing so would need to be continual, and could be timed to match flushing pulses or higher predator risk segments. Costs are being researched. Some dye products cannot be used in natural streams. Use of dye will require an HPA permit from WDFW and will require a permit modification to the APAM permit issued by Ecology.

Yakima River Segments by Reach

River Reach	Issues
Columbia River to the upstream limit of the McNary pool	Mostly silt bottom. Includes the east edge of Bateman Island up to the I-182 bridge. This area was mowed twice in 2024.
McNary Pool to Wanawish Dam	Too shallow, rocky and swift to harvest with current equipment in most places. There are minimal access points for machines to launch or offload material. Small boats could work in this reach of the river. The CID and Barker ranch diversions are located at Wanawish Dam.
Wanawish Dam to Chandler	Harvesting can be significantly increased in this reach and in the Wanawish pool. A larger harvester would work here. The pool is mostly 6 to 8 feet deep. Some harvesting has occurred near the Benton City boat launch, but not in 2024.
Chandler to Prosser Dam	This reach has lower flows, has not been harvested and may be able to be accessed with amphibious excavators in places. It may be possible to manipulate flows at times to aid in stargrass removal. There is major return flow point at the Chandler power plant.
Prosser Dam to Mabton	Harvesting can be increased in this reach. The Prosser pool is 10 to 15 feet deep in the middle. Takes two passes. There are boulders and tires in the pool among the grass. More access points and material offload points are needed to improve cycle times. KID's diversion is located at Prosser Dam. Takes two passes to harvest.
Upstream of Mabton	Smaller boats could access this reach. Shore access to launch boats and offload material is limited.

Permitting for Harvesting and Aquatic Herbicide Use

The DFW permit for harvesting stargrass has been issued by their area habitat biologist Michael Ritter (Troy Makis will handle permitting going forward). Currently, the harvesting work window is July 1 to August 31. The permit lists specific harvest areas. The window was expanded to September 15 in 2023 and 2024. Staff has been working with the DFW staff to expand the work window permanently on both ends of the season, when river conditions permit.

- ✓ The HPA work window is generally when salmon and steelhead smolts (and most adults) are generally not present in the lower river due to lethally hot water temperatures.

- ✓ A permit issued by the state department of Ecology is required to use aquatic herbicides, under the plant and algae management (APAM) general permit is required. Shawn Ultican is the Aquatic Permit Specialist who administers this permit. The controlling statute is RCW 43.21.660.

  The permit window is currently July 15 to September 15. Depending on the timing of the treatment it could necessitate an amendment to the DFW fish timing window.

- ✓ Kieth Folkerts at DFW in Olympia is technical expert who is consulted when aquatic herbicides are used in a river or lake.

- ✓ A solid waste disposal plan is required from the County health department for the cuttings when they are dried and disposed of at a landfill or composted.

  Several more locations are needed for drying the cuttings in close proximity to the areas being harvested if the cuttings must be removed from the river. Examples of drying beds are shown below.



A standard DFW permit provision requires machines operating in the water to use non-toxic lubricants.

Environmental review is required under state law and may be able to be streamlined due to the ongoing drought emergency.

<u>Priorities for Helping Salmon</u>

There does not yet appear to be consensus among the fish biologists as to the highest priority areas or times to improve conditions for fish (smolt outmigration vs adult up migration for multiple species). Those discussions are ongoing and may come together along these lines:

- ✓ Target the pools above Wanawish Dam and Prosser Dam first to help out-migrating smolt. Fish move mostly from April to mid-June which is before the harvesting occurs because of flows, plant depth and the permitted work window.
- ✓ Treat and focus on harvesting one side of the river at a time, or a lane/passageway initially;
- ✓ Treat one river segment at a time from the delta to upriver, rather than the entire river at once;
- ✓ Fall Chinook spawning beds downstream of Prosser, which have become overgrown and supported over 1,000 redds just a few years ago. Redd counts are now measured in dozens in these areas. Restoring the viability of these spawning areas is a long term goal beyond 2025.

Stargrass Control Expertise

There is very little research available on stargrass because it is not an invasive plant. USGS prepared a report about stargrass in the lower Yakima River in 2009.

We have been in contact with Scott O'Meara, USBR's botanist in Denver at the Technical Service Center. He specializes in controlling invasive aquatic weeds, and while he does not have stargrass specific knowledge, he does have applicable information.

We have also been in contact with Wes Glisson, Ecology's aquatic invasive weed specialist who specializes in controlling invasive aquatic weeds and does not have stargrass specific knowledge, but does have applicable aquatic weed knowledge.

Both have advised that it's important to not create a problem with a different plant, particularly an invasive species, such as flowering rush.

Texas A&M University advises that water stargrass decays in about two weeks in ponds and the DO issue can be managed by doing herbicide or harvest treatments in stages to avoid over overload the waterbody with oxygen depletion caused by decomposing plant tissue.

Botany Professor Charles Horn, from Newberry College in South Carolina, was a member of the technical advisory committee that was assembled by the Benton Conservation District. Professor Horn studied water stargrass in the 1980s.

The aquatic herbicide manufacturers also have technical expertise and some applicable scientific research which is being gather and reviewed to determine the most effective approach.

Near Term and Long-Term Program Funding & Cost Sharing

None of the measures described above currently have long term funding mechanisms in place.

An ongoing herbicide treatment program would cost $250,000 to $375,000 annually just for the chemicals at 2024 prices. Staff time, or a private applicator's services to make and monitor the treatments would be in addition to these costs.

A state capital grant was used to purchase a harvesting boat in 2021, which could work for additional machines in the future. It costs about $50,000 annually to operate and maintain the harvester for the 60-to-75-day harvest season. The Benton Conservation District employees who operate the machine are funded through an Ecology Coastal Spills Protection Grant which are year to year and are not currently funded beyond 2025. The Benton County Mosquito Control District has performed maintenance and repairs on the boat and trailer in their shop.

Stargrass is not eligible for state invasive control funds because it is a native plant. The unusual situation in the Yakima River may cause a need to attempt a change to the controlling statute to make some of the expenses eligible. Ecology staff have stated that funding falls far short of the statewide need.

Roza (and/or other irrigation districts) could provide operators at times, dump trucks and drivers, and potentially equipment maintenance and storage.

A new special purpose district could be formed and is being researched, as is a formal coalition of interests who are affected by stargrass proliferation. Several states authorize the creation of aquatic weed control districts. These need to be researched further.

All of these options take time to evolve. Other options are also being examined through the USBR, BIA, USDA, state agencies and others.

Other

- ✓ Ideally, we would engage with the mechanical harvester manufacturers, the chemical manufacturers and others in industry (who may be in competition with one another) in 2025 to formulate solutions that might be more efficient and beyond our current thinking, which is based on our limited knowledge of stargrass control.

- ✓ With limited financial resources the targeted expenditures need to be as efficient as possible. Many of the agencies in the basin are of the opinion that learning as we go is acceptable in order to facilitate immediate action in 2025, but the approach must be well thought out so as to avoid ineffective measures or inadvertently creating other problems in the river system.

- ✓ Mapping-Roza staff took 2022 mapping and aerial photo data from the Benton Conservation District and input them into the District's GIS system. 2022 was a full water supply year and the stargrass has spread significantly during the 2023 and 2024 low water years, which is not reflected in the mapping.

- ✓ There needs to be consensus established quickly on the overall strategy and expectations, permitting, funding, harvest logistics, efficiency optimization, etc.).

  Since no single agency is in charge of this, the overall effort is very diffused and things will slip through the cracks or won't get prioritized properly.

- ✓ Effects on irrigation diversions, pump intakes and canals:

  The Columbia Irrigation District (CID) had to staff their diversion intake for approximately 30+ straight days on a round-the-clock basis in 2024 to keep the stargrass off the screens so that water diversions could be made. CID also saw significant stargrass impacts in 2020 and 2023. CID spent nearly $18,000 in overtime in 2024 removing stargrass and nearly $90,000 over the past ten years in addition to $192,000 on aquatic herbicide.

Stargrass in the CID main canal in 2022. Stargrass has not yet been found in either the Roza or SVID canal systems yet.

- ✓ The Columbia Irrigation District, Yakama Nation, Benton Conservation District, Fisheries and Washinton Departments of Ecology and Fish & Wildlife all contributed to compiling the information in this report.

Preliminary Approach for 2025 Aquatic Herbicide Use and Harvesting

1. An herbicide treatment in the Prosser pool early to mid-April. Provided the water warms to 46 degrees, which typically occurs by early April or sooner. Treatments take 12 to 16 days to see the effects. An April treatment should prevent stargrass growth which will reduce the dissolved oxygen problem in July and August.

   Possibly in concert with a dye treatment, which also will require an HPA.

   - Modification of fish window by DFW under the APAM permit to treat before July 15;
   - Establish which agency is obtaining permit coverage;
   - Establish whose aquatics license the treatment will be made under;
   - Secure funding to pay for the treatment(s)

   Harvesting in the spring is not feasible on a large scale with the machine used now unless the lower river is in a very low flow condition and the water has warmed to promote plant growth. The plants are small in the spring, and in most years the water is deeper and swifter than can effectively be harvested with the current machine.

1. Begin mowing flow/migration lane(s) in the Prosser Pool in latter June if spring runoff flows allow, which requires an HPA permit modification to begin before July 1.

2. A second herbicide treatment in July or early August when the water is 60 degrees or warmer.

Steps that Need to Occur Soon for Action to Occur in 2025

1. Determine what is feasible in 2025 to help out migrating juveniles. This probably is limited to a chemical treatment if feasible, possible combined with dye to reduce growth of stargrass. Permitting needs to begin very soon. The process under the Ecology APAM permit takes 60 days from submission of a complete application and includes a 30 days public comment period.

   Determine if predator control through electro-shocking can or should be done just in advance of flushing pulse flows.

2. Determine what is feasible in 2025 to help returning adult sockeye. Fish begin returning about the time harvesting begins. An herbicide may be able to create a migration lane to reduce upstream travel times, which should also reduce the dissolved oxygen levels in places. If doing so is enough to make a difference in the DO levels is not yet known. Permitting needs to begin very soon.

3. Funding strategies for the various management measures in 2025.

4. Technical advice on the effects of cut materials on dissolved oxygen levels as they decay in larger amounts.

Steps that need to occur in 2025 for Implementation in 2026 and Beyond

1. An acquisition plan for more machines that can remove stargrass by the roots or to kill the plants in order to make longer term progress on control, which should improve the dissolved oxygen problem, reduce predation and restore salmon spawning beds over the long term. This could include a UV boat if the technology is effective.

   This also involves prioritizing which reaches of the river need to be addressed first and with which types of machines. Some machines may have long lead times to obtain (6 to 12 months +).

   It further involves determining the right type of machines for the areas that have not been accessible by the existing harvester, which is most of the river below Mabton that is not part of a pool upstream of a dam.

2. Machine interface to make sure that the equipment has the proper reach to get to the material in the river, and to get it off of the river (if required) in the fewest steps possible for disposal is critical for maximizing efficiencies.

3. Projected operational and maintenance costs for the additional machines.

4. Funding mechanisms for purchase (or seasonal lease in some cases) of additional machines, O&M costs and an annual herbicide program. One component could include a change to statutes and additional funding through Ecology's aquatic weed control program.

5. Logistical and operational issues all need to be worked out, such as:
   - safety plans for operations in and near the water;
   - machine security during the harvest season;
   - machine transport between locations;
   - machine maintenance, and
   - off-season storage.

6. Many more access points (e.g. dozens) to get machines in the water, to off-load material efficiently if it cannot drift downstream, and locations where it can be dried.

   The problem is so bad in the Prosser pool and just upstream of the McNary pool that landowners may be willing to allow access to the river through their private properties to launch machines or offload materials in order to make progress on control of the stargrass.

7. Determine what work can be contracted between agencies to avoid duplicating administrative functions.

8. Determine what work can be contracted to the private sector. Similar to the manner in which the USFS handles trail maintenance in some places.

   Determine if a bounty is feasible for people/property owners who harvest stargrass themselves (e.g. by the ton or cubic yard). This occurs now on a limited basis by some property owners and it might be possible to upscale it.

9. Engage with the equipment manufacturers to see if modifications to machines can be made to improve overall efficiencies, particularly with removal of stargrass at the root.