Galiano Island B.C. V0N 1P0 26 April 2022

Dear Trustees,

Re: Islands Trust Proposed Policies on Desalination, Docks and Seawalls

I am writing as an engineering physicist with extensive experience in the relevant fields of seawater desalination technology, ocean engineering and physical oceanography.

In the desalination field, I had a leading role 40 years ago in developing energy recovery devices for reverse osmosis equipment in survival, shipboard and land-based applications. Some breakthrough results included development of the first practicable manually powered seawater desalinators, and successful operation of household-sized desalination units on photovoltaic solar power.

I am presently collaborating with an international team of glaciologists exploring possible strategies for mitigating future sea level rise by stabilizing the vulnerable ocean edges of the polar ice sheets that are being ablated by intruding deep layers of warm and salty seawater. This project is investigating circulation and mixing between stratified ocean layers of differing salinity and temperature, with the same science that applies at much smaller scale to the dispersal of the salty discharge from desalination plants.

The Islands Trust has recently distributed a topical “Fact Sheet” with arguments for abolishing water supply by desalination, additional private docks, and shoreline protection by seawalls The “Fact Sheet” suggests that seawater desalination is overly energy-intensive and may have environmentally harmful discharges.

Energy consumption of modern reverse osmosis systems is only 4 kWh per cubic meter of high quality fresh water extracted from the ocean. No chemicals are added or released by the process. Good design practice for small scale desalination is to operate at about 20% recovery of purified water from the feed seawater, so the salt concentration of the wastewater is enriched by the same ratio. The wastewater from a small desalination unit will be returned to the sea as a turbulent fluid jet from the end of the discharge pipe, and will rapidly be diluted and dispersed as surrounding seawater is entrained by venturi action to mix into the jet flow. This mixing action would rapidly reduce the salinity enrichment to be insignificant within a few meters of the discharge point.

Because of heavy seasonal rainfall, large freshwater discharges from the Fraser and other rivers, and strong tidal mixing from Juan de Fuca and Johnstone Straits, marine biota of the Salish Sea are acclimatized to highly variable salinities that are significantly less than the salinity 75 2 of the open Pacific Ocean west of Vancouver Island. The environmental effects of small scale reverse osmosis desalination in our region would be essentially undetectable.

Large scale desalination applies to arid regions of the world where the feed seawater salinity will be higher than our relatively dilute seawater. Larger desalination plants typically operate at higher recovery than small reverse osmosis units, thus generating large flows of high salinity waste brine with modified chemistry. Marine environmental impacts of large desalination plants on coasts with high salinity require careful consideration and management. There is no need or remotely realistic prospect of large scale desalination in the Trust area, as surface water and groundwater production from drilled wells will always be significantly less expensive than seawater desalination for village supply because of the more demanding maintenance requirements of reverse osmosis equipment.

While the installation cost of household desalination equipment may be in the same range as a drilled well, the relative complexity and operating costs of desalination will restrict its use in the Trust area to niche applications where other fresh water supplies from wells and rainfall are inadequate. It should be emphasized that seawater desalination is an entirely practicable and affordable option which guarantees overall self-sufficiency of our islands in water supply.

Private docks can provide ideally convenient intake and outfall points for household desalination units. Docks have important roles for connecting islands to the water and to other islands, as well as providing emergency evacuation points. Sensitive design and careful installation are needed to minimize ecological and aesthetic impacts.

Sea level rise in the Trust area from present mean sea level is expected to be about 20 cm until 2050, accelerating to about 1 m by 2100 with worst case predictions a factor of two higher. Many waterfront owners will become concerned about shoreline erosion. Where feasible, soft protection would be preferable to the hard armouring that may be necessary in some situations. Qualified professional advice will be needed to advise on minimally disruptive solutions, with careful attention to effects on neighbouring shoreline areas. While the Trust should be advocating necessary education and responsibly sensitive approaches, it can be expected that senior governments will take the lead role.

In my opinion, there is no justification whatsoever for the suggested blanket prohibitions of desalination, docks and seawalls. As a Galiano Islander who strongly supports the principles of the Trust Object, I would like the Trust to be advocating good education of islanders and their contractors for best possible results rather than devising new regulatory functions for itself.

With best regards, Bowie Keefer, Ph.D., P.Eng.