BOWDOINHAM
ON BEAUTIFUL MERRYMEETING BAY

Evaluation of Recycling Glass
Fact Sheet

EXECUTIVE SUMMARY:

The Solid Waste Committee evaluated the feasibility of Bowdoinham accepting glass as a recyclable material. In doing this evaluation we identified three Critical Success Factors (CSF)[1]:

1. Increase to Solid Waste Budget, if any, must be approved by citizens.
2. Recycled glass must be beneficial to the environment; reused as source material for new product or used for secondary purposes, either of which would lessen the need for new materials.
3. Safety for both Solid Waste staff and general public must be maintained/mitigated.

Failing just one CSF means the project would fail to be viable.

We evaluated this question over the past several months by doing external research, consulting with Town experts (both Solid Waste and Public Works) and interviewing external partners/vendors/other Towns/related businesses.

After thorough evaluation (outlined below) it was determined that, like many other smaller municipalities throughout the country, it is not economically or environmentally feasible to accept glass as a recyclable material.

INTRODUCTION:

The Bowdoinham Select Board has asked the Solid Waste Committee to research accepting glass as a recycled resource again. They have further specified that two options should be researched:

1. Recycling the glass with a third party, and
2. The Town processing and using the glass materials.

GENERAL FACTS

Recycling costs tax payer money:

[1] A CSF is a condition that must go right to reach a goal, i.e. What must go right, or what if goes wrong jeopardizes the goal.

- Currently glass is discarded in trash where user paid trash tickets cover the total costs of the program.[2]
- The Town pays for recycling from tax revenue
  - Costs are somewhat offset by value of materials being recycled, e.g. corrugated cardboard.
  - Costs will be further offset starting in 2027 by the State's EPR (Extended Producer Responsibility) program.
  - While recycling costs are offset, recycling is still a net cost to the Town
- The variable cost of recycling is ≈ 15% lower than the variable cost of trash, based on 2025 calendar year data. However when including the fixed cost of staffing the cost of recycling is significantly greater than the cost of trash on a tonnage basis. Please also note this is not an 'apples to apples' comparison as trash is a curbside collection model. If recycling were also a curbside model variable recycling costs would be slightly higher than trash.
- *Trash is paid by users (heavier users pay the cost of their usage), recycling is paid through taxes and is supported by all citizens regardless of program usage*.
- Town citizens have continually supported recycling, based on positive impact to the environment[3].
- State of Maine encourages recycling , "It has been Maine's goal since 1989 to reach a recycling rate of 50% of our municipal solid waste generated."[4] This goal was set for environmental purposes.
- Town of Topsham (and others, e.g. Oakland) who collect glass bury the glass on their sites, there is no reuse of the materials. Given the high portion of Public Works land (over 50%) that has been designated as wetlands, Bowdoinham has no place to bury glass.

History of recycling glass in Bowdoinham:

- Bowdoinham accepted sorted, clean glass until 2020 when the Material Recovery Facility (Strategic Materials in Medford, MA ≈ 140 miles from Bowdoinham), that used the class for recycled purposes, closed.
- Glass was separated by material, but not by color. New MRFs generally require sort by color.

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[2] From Solid Waste Ordinance 7.1.2 Fees: The Town shall fund trash program through a usage based fee … shall be set at a level projected to cover all costs of trash collection, transportation and disposal.

[3] In a 2020 town survey 91.3% of respondents strongly/very strongly supported recycling, comments included "divert items from going into the landfill.", "We have an environmental crisis, and the town should be addressing the issue with passion …", "I'd like the town to continue to be a leader in trying to save the planet.", "Environment if the hot word today", "Do the right thing for Bowdoinham and the climate". "… our program is best for our environment", "protect Bowdoinham's environment", "Recycling is vital to the town and to our environment."

[4] https://www.maine.gov/dep/waste/recycle/

- Bowdoinham looked at other uses for glass at that time, however due to low market value[5] the Town was not able to find a solution that worked economically.
- Since 2020 only one new MRF has opened in New England (Sibelco ≈ 180 miles away in Hopedale, MA), We have not found any trucking vendor willing to truck glass for us given the weight of glass and the distance involved meaning this is not a viable option. Broken glass (not cullet) weighs ≈ 1,500 LBS per yard; for a 40 yard truck this would be 60,000 LBS. As there is no viable MRF within reasonable distance for Bowdoinham, the market value of glass has not changed since Bowdoinham determined recycling glass was not economically feasible.

General facts on recycling glass:

- Glass is significantly heavy, it weighs about 10 times as much as a similar volume of plastic or aluminum[6]. This impacts trucking costs.
- In 2014, trucking heavy material more than 200 miles was not economically feasible. [7] Given the increase in fuel costs since 2014 the economically viable milage has decreased significantly.
- There is no facility within an economically feasible distance that accepts clean sorted glass (optimally by color - clear (#GL70), green (#GL71) and brown (#GL72)) to processes into new product.
- The majority of municipal glass recycling in Maine is either through single stream recycling, e.g. Casella, Bowdoinham's current recycling vendor or where the municipality buries the glass and does not 'recycle/reuse'.

POSSIBLE AVENUES FOR ACCEPTING GLASS FOR RECYCLING IN BOWDOINHAM

Recycling the glass with a third party

CSF #1 - impact on taxpayer cost:

- Based on weight of glass Bowdoinham's recycling tonnage will increase and recycling cost will increase.
- The Town's former Public Works Director[8] estimated volume from the pilot recycling program run from the Barn was 2 tons/month. If we estimate that 1/3 of the citizens participated in the pilot, and the estimated Casella rate[9], annual cost could be as high as ≈

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5 Conversation between David Berry and Eric Hamlin Maine DEP documented in 7/23/2020 email.

6 https://www.sierraclub.org/sierra/why-isnt-there-one-easy-way-recycle-glass

7 https://www.wbur.org/news/2023/07/14/glass-recycling-massachusetts

8 Information provided by David Berry during the 4/8/2026 SWC meeting, see minutes for complete conversation.

9 Casella charges a per ton rate for materials and a fixed rate for transport. For CY25 the average cost based on tonnage was $332.78, to account for 18 months between CY25 and FY27 we estimated a ≈10% increase or $366/ton.

$25,352/year (a 11.6% increase in SW Budget). First year cost would be higher as citizens are currently accumulating glass. This is a rough estimate, but even at 75% of this estimate the additional taxpayer cost could be ≈ $20,000/year.

- The cost of recycling also depends on the 'quality' of our recyclable material, Casella can charge more if Bowdoinham's recycled material is contaminated, e.g. food remnants in containers, this can be common in glass containers.

CSF #2 - Environmental impact

- As glass is crushed in compacting the glass shards become a contaminant, lodging in cardboard, paper and plastic, effectively eliminating its value for sale[10].
- Casella (and Eco Maine) use the recycled glass only on their own roads/ driveways or to cap their own landfills. Neither company actually recycles material (e.g. for reuse), for public purposes.
  - Picture at right is Casella's glass pile in March, '23. This shows the contamination level, clearly shown are plastic bottles, plastic lids, metal objects, cardboard, etc. This quality only supports Casella specific uses, e.g. does not support environmental causes other than internal to Casella.

CSF #3 - Safety of staff and public

- The broken glass also becomes a hazard to Solid Waste Department workers requiring Personal Protective Equipment such as special gloves (see example at $33/pair), safety goggles, steel toed boots and possibly hard hats.

Conclusion: Sending recycled glass to a third party would cost tax payers more money (CSF #1) and would not support any environmental or conservation benefits (CSF #2), any safety concerns could be mitigated with purchase of PPE (CSF #3).

The Town processing the glass into cullet (crushed glass) and using the cullet:

CSF #1 - impact of taxpayer cost:

- Bowdoinham owns a glass crusher[11]
  - Given to the town ca 1995, it has not been used by 1999. It is currently stored/on a pallet at Public Works.
  - As machine has been stored for over 25 years would need to be maintained. Machine's rubber flap parts minimally would need to be replaced. We do not know if the machine can be made operational or if it will be operational at minimal cost.
  - Glass crusher has a 3-phase motor requiring specific electrical work, including purchasing a power inverter to get power to the machine. Paul Denis, Electrical

[10] https://www.roadrunnerwm.com/blog/why-is-glass-recycling-going-away

[11] A Prodeva Can and Glass Crusher Model 150

Engineer (Vice Chair of Solid Waste Committee) with years of experience with 3 phase motors has estimated the cost of this would range from $10K to $15K. If we move forward with this option the Town will need to get a firmer estimate.

- Glass crushing process (i.e.making cullet) would need to happen in an area separated from current recycling[12] and be stored on a cement pad (would need to be built) for both logistic (inadequate room in current location) and safety reasons.
- Processing glass into cullet adds tasks to the current staff requiring additional hours or part-time staffing or reduction in current tasks (staff is used efficiently and has no 'extra' capacity at current staffing hours).
- The crushed cullet cannot be used in Bowdoinham (see below) so would need to be transferred to destination[13] using Town front end loaders/trucks, or trucked by independent third party (costing ≈ $461/load for short distances). This would increase wear on equipment as well as additional safety hazards as sharp glass shards falling off loader/truck.

CSF #2 - Environmental impact

- Some towns (e.g.Topsham, Oakland) bury recycled glass on public land, Bowdoinham's public works land has a large portion of wet lands, glass in any form cannot be buried on wet lands. Burying glass does not benefit environmental purposes (i.e., no reuse), it only uses a different location than landfill.
- Possible private users: Per Doug Tourtelotte (Tourtelotte Excavation) he has an old granite pit where he could bury recycled glass, either processed into cullet or not, depth would be 12' to 15'. The glass would need to meet Maine standards for inert fill (the glass must be clean to ensure that contaminants such as metal or plastic caps, lids, and container contents are minimized to the extent possible). Tourtelotte Excavation would not use cullet in any fill they provide and would not use cullet on any private land. As it has no resource value to the business they could not pay the Town for the cullet, and the Town would need to transport it. The Town would need to ensure clean glass then transport it without any compensation (CSF #1).
- Some States allow cullet as fill to use in hot top, Maine does not. The Town contracts out paving for Town roads. We do not mix our own hot top thus could not use cullet. Paving vendors (Crooker Construction who Bowdoinham uses as well as other major contractors we contacted) do not use cullet in their hot top.
- The State does allow for cullet to be used as inert fill[14] To be used in this matter the glass *must* be clean to ensure that contaminants such as metal or plastic caps, lids, and container contents are minimized to the extent possible; (the State) does not expect removal of

[12] Would still be on public works land, just separate from current recycling

[13] Assuming we can find a destination willing to accept it - to date we have not found any entity willing to accept

[14] (from 06-096 C.M. R 400) **Inert Fill** means clean soil material, including … crushed clean glass or porcelain:

labels since this is really not practical. [15] There are very serious safety concerns with using cullet as fill (see below).

CSF #3 - Safety of staff and public

- Sound levels may be above 88 decibels requiring a Hearing conservation program[16] (which entails having employees hearing tested each year). To determine decibel levels we would need to set up machine (i.e. incurring cost to set up electrical) and test levels while machine is in use.
- In addition to Personal Protective Equipment noted above the Town would need to obtain professional respirator masks to protect from glass dust (estimate cost $120 to $400/mask) and hearing protectors (≈ $35-$50 per employee).
- The cohesion of cullet glass is typically characterized by a **lack of cohesion** when used as an unbound geotechnical fill, largely due to the smooth surfaces of the crushed particles. As an engineering fill, pure glass cullet generally exhibits negligible cohesion[17] From the International Society for Soil Mechanics and Geotechnical Engineering (link in footnote below). This means:
  - The fill is not stable, for example if used as a base layer it will 'slip' and the repair using said fill will 'sink'. Bowdoinham's Public Works department often 'fixes' culverts that are on people's personal land but are within the Town's right of way. Using cullet as a layer of fill for these types of repairs will result in a higher failure rate. No structure can be build on fill that includes cullet.
  - The glass will migrate towards the surface, causing hazards for anyone whose land it is used on. Children and pets would be particularly susceptible to harm, possibly pet death should they 'eat' the cullet. Plants will incorporate cullet (in root systems, etc.) making ingestion by animals more likely. This would increase the Town's liability based on using 'unsafe' material. Based on depth and type of soil the timing of migration to surface will vary. Public Works tasks generally use fill at shallow levels, e.g., fill for fixing culverts. Bowdoinham's Public Works cannot use cullet on private property due to safety and structural integrity concerns.
  - There are also hazards for any Public Works employee using cullet, potential Worker's Compensation including, medical expenses, mileage for appointments, weekly income benefits for missed work (temporary/permanent disability), and vocational rehabilitation (e.g. if nerves are severed). While most of these possibilities would be rare, lacerations requiring stitches are more possible and would be covered.

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[15] 7/23/2020 email from Eric Hamlin Maine DEP to former SW Director David Berry

[16] In accordance with IAW OSHA 1910.95

[17] https://www.issmge.org/uploads/publications/1/21/STAL9781607500315-0201.pdf#:~:text=This%20includes%20using%20recycled%20glass%20as%20asphalt,fine%20clay%20size%20particles%20in%20the%20mixture .

Conclusion: TheTown processing and using the glass would cost tax payers more money (CSF #1), would not support environmental or conservation benefits (CSF #2) and would add hazard to the Town's Solid Waste and Public Works employees (which could be mitigated by additional PPE), and would present hazards to citizens and possibly their livestock, pets and/or children (CSF #3).

OVERALL CONCLUSION

After thorough evaluation it was determined that, like many other smaller municipalities throughout the country, it is not economically or environmentally feasible to accept glass for recycling. Outlined below is a recap of how each recycling method (single stream or processing into cullet for local usage) meets/doesn't meet the Critical Success Factors needed to make this viable for Bowdoinham.

Method One - putting glass into recycling:

🚫 CSF #1 - Cost; would increase town costs by moving tons of what is currently trash (user paid) to taxpayer paid at a higher rate. The estimated increase would be >10% of Solid Waste budget which has already been set as a no change for FY27. It would also cost PPE equipment, although the PPE cost for this method would be minimal.

🚫 CSF #2 - Environment; The glass provides no environmental benefits, i.e. material is not reused, other than a benefit to a private company (Casella or Eco Maine).

✅ CSF #3 - Safety - safety concerns can be mitigated by purchasing PPE for staff. This does impact CSF #1 as it would increase costs, however this increase would be <$1,000.

Method Two - the Town processing glass into cullet for possible use.

🚫 CSF #1 - Cost; the town would need to

- pay to refurbish crusher
- pay to set up electrical
- pay to develop separate area for cullet, including pouring cement pad and possible additional equipment.
- pay for additional PPE for employees

🚫 CSF #2 - Environment; cullet cannot be used (in Maine) for hot top nor can it be used by the town for fill (individuals can use it on their own property). There are no practical uses for municipalities to use cullet in Maine.

🚫 CSF #3 - Safety; safety concerns for staff can be mitigated by purchasing PPE, however safety to public (people and livestock/pets) could be severe and cannot be mitigated as glass' lack of cohesion would lead to glass particles migrating to the surface.

Neither of the two alternatives explored, putting into recycling or crushing to produce cullet, satisfy the Critical Success Factors. Each method would increase taxpayer costs through Solid Waste Department budget increases, neither method would deliver substantive

environmental or conservation benefits, and while safety concerns for Bowdoinham employees could be mitigated through purchase of PPE safety to the citizens using cullet could not be mitigated and represents an increased liability to the Town.

At this time, given the facts outlined above, the Solid Waste Committee advises that glass materials not be considered as recyclable material.

Further Reading:

What happens to the glass containers you think you're recycling: *https://www.wbur.org/news/2023/07/14/glass-recycling-massachusetts*

Why Isn't there One Easy Way to Recycle Glass: *https://www.sierraclub.org/sierra/why-isnt-there-one-easy-way-recycle-glass*

Why Is Glass Recycling Going Away: *https://www.roadrunnerwm.com/blog/why-is-glass-recycling-going-away*

Why Glass Recycling in the US is broken: *https://cen.acs.org/materials/inorganic-chemistry/glass-recycling-US-broken/97/i6*

The Future of Glass Recycling – Is it going Away?: *https://www.rts.com/blog/the-future-of-glass-recycling/*

Recycling Right: Understanding why glass can't go in the commingled recycling cart: *https://roguedisposal.com/resources/education/recycling/recycling-right-glass-understanding-why-glass-cant-go-in-the-commingled-recycling-cart*

Can the broken US glass recycling system be fixed?: *https://ceramics.org/ceramic-tech-today/can-the-broken-us-glass-recycling-system-be-fixed/*