Littleton Colorado

Memorandum

To: Jim Becklenberg, City Manager
From: Brent Soderlin, Director of Public Works and Utilities
Date: January 28, 2026
Re: Ketring Lake Water Management Strategies

Executive Summary

Ketring Lake, a central amenity in Ketring Park, provides significant recreational and ecological value but faces chronic water deficits driven by evaporation, seepage through an aging liner, and insufficient supply from Arapahoe Well #1. Historic deliveries from the High Line Canal are no longer viable. Potable water is constrained under Denver Water's Service Agreement and is not a sustainable long-term solution.

Water demand at Ketring Lake is currently estimated at **61.5 acre-feet annually**, driven by wetland irrigation (5.7 ac-ft), evaporation (29.1 ac-ft), and seepage (26.7 ac-ft). The existing Arapahoe Well #1 has consistently underperformed, despite rehabilitation efforts, far short of its 76 ac-ft permitted withdrawal capacity. The existing well provides approximately 11 gallon per minute (gpm) to the lake. Generating roughly 17.7 acre-feet of water. Leaving water deficiency of 43.8 acre-feet. Consequently, the lake experiences annual water shortages, which were exacerbated by the dry conditions we experienced in 2025.

Potential strategies under consideration include:

- **Resize the lake and convert it to a wetland:** This presents an opportunity to match the existing production from Arapahoe Well #1. It also embraces our sustainability goals for reduced water use and is a long-term approach to water management, even during drought years.
- **Resize Lake and maintain permanent pool**: Downsize the lake to match the production from Arapahoe Well #1. This strategy would include lining, and we would maintain water in the lake, but it would reduce the overall area of the lake.
- **Construction of a new Denver Basin well**: Costs are high (≈ $1M) and aquifer water quality and quantity remains uncertain.
- **Use of City Ditch** Contract Water to meet needs at Ketring Lake: The Permontes Group evaluated several options for delivering City Ditch water to Ketring Lake in 2020. Delivery of City Ditch water to Ketring Pond would have an infrastructure cost of ≈ $900k.
- **McClellan Reservoir:** A total of **16 ac-ft per year** of water from McLellan Reservoir may be available to Littleton pursuant to the terms and conditions of the stipulation in Case No. 89CW062. Costs have yet to be determined

- **Replacement of the 2003 PVC liner**: The condition has deteriorated and is likely contributing to seepage losses; estimated cost ≈ $2.19 million. This is not a viable strategy unless we find enough water to maintain the lake.
- **Rehabilitation of Arapahoe Well #1:** Work is completed but well performance remains insufficient.

This memo synthesizes existing technical studies and feasibility reports, outlines the lake's current water balance and financial constraints, and evaluates viable pathways for creating a more sustainable long-term water management plan for Ketring Lake.

Background

Ketring Lake is a man-made reservoir with a surface area of 11.2 acres and a storage capacity of approximately 98 acre-feet at its normal high-water level. The lake has long served both ecological and community functions, supporting adjacent wetlands, enhancing landscape aesthetics, and supplementing irrigation for the Littleton Museum grounds.

Historically, the lake was supplied with water from the High Line Canal through a private lateral channel known as the Arbor Ditch. These deliveries were sufficient to maintain lake levels for decades. However, the High Line Canal is no longer being used by Denver Water to convey contracted water to users along the canal. Currently the portion of the canal through Littleton has been conveyed to Arapahoe County and its future is as a conservation corridor and water quality facilities through the city. In addition to the reduced flows, climate change and recent drought conditions limit the HLC as a viable alternative to supply water to Ketring Lake.

In 2012, following an exceptionally dry year, Denver Water delivered approximately 45.8 acre-feet of potable water to Ketring Lake via a temporary hydrant and hose system. While this emergency measure replenished the lake, it underscored both the financial burden and unsustainable reliance on treated potable water for lake filling. Subsequent years have seen similar challenges, with Denver Basin groundwater resources being introduced to reduce dependence on potable water. Staff recently contacted Denver Water regarding the use of potable water to fill the lake. Denver Water informed us that potable water cannot be used for this purpose due to their current water storage levels and the one-time exception made to their operating rules in 2012. This exception was intended to address the situation temporarily, with the understanding that a more sustainable solution would be implemented.

A PVC liner was installed in 2003 to reduce seepage losses. This system covered approximately 620,000 square feet at a cost of roughly $716,000. However, minimal ballast was used during installation, and some liner sections remain exposed along the shoreline. After two decades, both normal wear and suspected damage have compromised its effectiveness, contributing to measurable seepage losses. In 2023 a seepage study estimates losses at 26.7 acre-feet per year, confirming that the liner is operating below intended performance levels.

Municipal efforts to supplement supply with groundwater have centered around Arapahoe Well #1,

which is legally permitted to withdraw up to 76 ac-ft annually. Despite rehabilitation attempts in 2023, the well has failed to deliver anywhere near this capacity. Additional groundwater rights exist in both the Arapahoe and Laramie-Fox Hills aquifers, yet there are limitations in terms of uncertain production rates, water quality concerns, and construction costs.

Over the years, multiple technical assessments have been carried out to evaluate water demand and infrastructure needs for the lake. Notably:

- A 2014 Feasibility Study by Wright Water Engineers estimated total annual demand at 85.6 ac-ft, though this figure included areas already irrigated with Denver Water supplies, likely overstating actual needs.
- A 2020 Technical Memorandum by the Permontes Group placed annual demand at 57.5 ac-ft, primarily driven by evaporation and seepage.
- The 2023 Littleton Integrated Water Resources Plan provided more refined estimates, concluding that total demand is closer to 76.1 acre-feet per year, balancing irrigation (museum and wetlands), evaporation, and seepage.

This historical context highlights two core realities:

1. Reliance on declining or unreliable sources has created unsustainable costs for the city.
2. Infrastructure solutions implemented in prior decades (liner, well) have degraded or underperformed, accelerating the need for long-term planning.

The following sections will analyze current operational challenges, summarize cost implications, and explore feasible pathways to reestablish a reliable, sustainable water balance at Ketring Lake.

Current Conditions & Challenges

Annual Water Demands

The 2023 Littleton Integrated Water Resources Plan estimate that Ketring Lake requires approximately 76.1 acre-feet of water per year to remain full and meet park-related needs. Water demand is distributed across four categories (Table 1):

Table 1. Ketring Park Water Demands (2023 Estimates)

Demand Area	Acreage (ac)	Volume (ac-ft/yr)
Museum Irrigation	4.7	14.6
Wetland Irrigation	1.5	5.7
Evaporation	11.2 (lake surface)	29.1
Seepage	—	26.7
Total	17.4	**76.1**

The largest single source of demand stems from **evaporation** (38% of total annual loss), followed closely by **seepage through the compromised liner** (35%). Together, these physical losses make up over 70% of the lake's annual water requirements. This imbalance highlights the need for infrastructure rehabilitation to reduce non-beneficial losses.

Groundwater Supply Limitations

The primary non-potable water supply option is Arapahoe Well #1, which is legally permitted to produce up to 76 ac-ft/year—a volume theoretically sufficient to sustain the lake's requirements. However, field performance has been well below expectations. Even following significant rehabilitation efforts in August 2023 (including casing work and installation of new equipment), yield has remained underwhelming.

Previous consultant reports caution that aquifer productivity in this region is inconsistent. Wells completed in the Arapahoe formation frequently produce only a fraction of their permitted allocation. While the Laramie-Fox Hills aquifer represents another groundwater option, past data indicates questionable water quality, raising concerns about its suitability for irrigation or discharge into the lake without treatment.

The cost of drilling a new Denver Basin well has been estimated at approximately $1M, excluding long-term operational costs such as pumping energy, ongoing rehabilitation, and water quality management.

Infrastructure: Aging PVC Liner

The PVC liner installed in 2003 was expected to provide a functional lifespan of about 20 years. Now at or beyond that threshold, its integrity has visibly deteriorated. Exposed liner edges contribute to increased weathering, and seepage studies confirm that water losses remain significant.

Replacement of the liner has been estimated at $1.75 million, with total project costs (including engineering, permitting, and contingency) potentially reaching $2.19 million. Balancing this investment against achievable water savings is central to the city's decision-making. If seepage losses (26.7 ac-ft/yr) could be substantially reduced, liner replacement would yield long-term efficiency gains but requires high upfront expenditures.

Potable Water Use

Potable water has been regularly used to irrigate the Museum and Ketring Park due to a lack of reliable non-potable sources. Currently, the annual irrigation cost for Ketring Park is estimated at $45,812.88.

In 2012, a notable incident occurred when approximately 45.8 acre-feet of potable water was diverted from a Denver Water fire hydrant to refill the lake. While this solution was effective in restoring the lake's levels in the short term, it is not practical for the long run, as it violates Denver Water's operating rules, and we are constrained by the 2011 Denver Water Service Agreement (no hydrant filling; no reuse or commingling). We are actively seeking more financially sustainable and long-term solutions for maintaining the lake.

City Ditch

Additional City Ditch contract water could also possibly be acquired to meet needs at Ketring Lake, however there would be several obstacles to this. The underlying water right may need to be changed in Water Court to allow it to be used and stored outside of the historical ditch service area. A historical consumptive use analysis may also have to be conducted on the portion of the water right being changed, with unknown results. Additional infrastructure would be needed to physically deliver this water to Ketring Lake, which would include pumping City Ditch water supply or installing piping into the HLC to the lake. In the previously referenced water conveyance planning study completed in 2020 and a follow-up memorandum in 2021, the Permontes Group evaluated options for delivering City Ditch water to Ketring, with the following conclusion:

- Delivery of City Ditch water to Ketring Pond would have an infrastructure cost of $900,000.

McLellan Reservoir

Littleton has a right to 35 ac-ft per year of water supply in McLellan Reservoir to be supplied by Englewood in accordance with a stipulation entered into between Littleton and Englewood in Case No. 89CW062. At present, 19 ac-ft per year is committed to a plan for augmentation for Cooley Lake, a former gravel pit that requires perpetual augmentation to replace evaporative losses from exposed groundwater. The 19 ac-ft per year is released from McLellan Reservoir to the South Platte River to offset the depletions from these evaporative losses, and operation of this augmentation plan is decreed in Case No. 93CW11. A total of **16 ac-ft per year** of water from McLellan Reservoir may be available to Littleton pursuant to the terms and conditions of the stipulation in Case No. 89CW062. Any provision of additional water pursuant to this stipulation would need to be discussed with Englewood to ensure compliance with the stipulation terms.

Although releases could physically be made to the City Ditch using existing infrastructure, the stipulation in Case No. 89CW062 identifies the place of delivery as the confluence of Dad Clark Gulch and the South Platte River. Use of the High Line Canal, or other infrastructure to deliver water to Ketring Lake would require Englewood’s designation of those structures as delivery locations under the stipulation. In order to physically deliver McLellan Reservoir water to Ketring

Lake, new infrastructure would be needed to either pump the water directly to lake via pipeline, or to pump the water a short distance into the High Line Canal for gravity delivery to the parks.

The unused portion of this water is a potential source to meet demands at Ketring Lake. It could be a physical water supply if 1) future delivery locations and uses are consistent with the stipulation in Case No. 89CW062, and 2) the necessary infrastructure was built. Alternatively, it could be an augmentation supply to offset depletions from a different physical water source (such as stormwater or an additional shallow alluvial well) used to fill Ketring Lake. However, staff foresees some potential barriers to this use of the McLellan Reservoir water in this way. First, the cost of the new infrastructure may be substantial and has yet to be quantified. Second, the stipulation signed by Englewood is specific about the allowed uses; paragraph 2.3 of the stipulation states the following: "The water will be used by Littleton for municipal purposes, including to augment the flow of the South Platte River to compensate for evaporation from gravel pit lakes located within the present boundaries of Littleton." It is unclear whether the proposed use at Ketring Lake would fall within this relatively narrow definition.

Key Challenges Summary

- High evaporative and seepage losses are responsible for more than two-thirds of annual water demand.
- Arapahoe Well #1 remains underperforming, with uncertain groundwater availability and quality from alternative aquifers.
- Infrastructure replacement needs (liner) carry high costs, estimated at $2.19 million.
- Potable water use is unsustainable, both from the availability from Denver water and environmentally.
- The use of contract water from City Ditch carries a high infrastructure cost and the underlying water right may need to be adjudicated in Water Court.
- The 16 ac-ft available from McLellan Reservoir may be available but infrastructure costs need to be determined, and availability is subject to the augmentation plan decreed in Case No. 93CW11.

These challenges underscore the need for a balanced strategy that prioritizes sustainability, cost-effectiveness, and system reliability over short-term fixes.

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Options for Consideration

Option 1: Operational resizing and convert to a wetland (no liner replacement)

- Scope: Reduce lake area to match well yield; no lining.
- Costs: Moderate to high (earthwork, bank protection).
- O&M: Moderate (ongoing make-up water due to persistent seepage).
- Yield/reliability: Moderate—demand reduced but seepage remains significant; higher long-run costs.
- Legal feasibility: High.

Risks: Continued non-beneficial losses; may not adequately stabilize levels in dry years

Option 2: Right-size lake + replace liner; keep museum/park irrigation on potable

- Scope: Reduce lake surface area to match verified well yield; replace liner with heavier RPE or equivalent; shoreline stabilization and ballast improvements; discontinue museum irrigation from lake.
- Costs: Moderate to high (liner and modest earthwork; your planning estimate ≈$2.19M for lining; add allowance for grading/amenities if downsizing).
- O&M: Low to moderate (routine inspection, minimal pumping energy if relying primarily on well).
- Yield/reliability: High—demand tailored to dependable well output; seepage reduced from ≈26.7 ac-ft/yr to ≤5 ac-ft/yr target.
- Legal feasibility: High—no new decrees required.
- Risks: Public perception of smaller lake; manage via amenity enhancements and interpretation.

Option 3: New Denver Basin well + replace liner; maintain lake area

- Scope: Drill new well (Arapahoe/LFH), equip and connect; replace liner; retain current surface area.
- Costs: High (≈$1M for well plus ≈$2.19M lining and ancillary improvements).
- O&M: Moderate (pumping energy, maintenance, potential treatment for iron/manganese/TDS).
- Yield/reliability: Uncertain—site-specific production quality and rate variability; pilot testing advised.
- Legal feasibility: High—rights decreed in 98CW288; some volumes non-tributary (no augmentation).
- Risks: Underperformance; water quality; long lead times.

Option 4: City Ditch delivery to Ketring + replace liner

- Scope: Secure additional City Ditch contract water; pursue change case if used/stored outside service area; build conveyance (≈$900k 2020 estimate; escalate); replace liner.
- Costs: High (legal + conveyance + lining). Approximately $3M.
- O&M: Moderate (pumping, metering, ditch coordination).
- Yield/reliability: Seasonal; constrained by ditch operations and legal outcomes.
- Legal feasibility: Medium—dependent on Water Court change case and CDWR administration (72-hour storage policy; municipal-use latitude may help).
- Risks: Legal uncertainty; schedule; seasonal availability.

Option 5: McLellan Reservoir (≈16 ac-ft/yr) + supplemental source with augmentation + replace liner

- Scope: Use up to 16 ac-ft/yr via locations/uses consistent with 89CW062 (may require Englewood agreement to designate delivery structures); add supplemental physical source (e.g., stormwater, shallow alluvial well) under an augmentation plan; replace liner.
- Costs: Medium to high (infrastructure to deliver from McLellan; augmentation engineering/legal; lining). Costs have not been calculated but I would estimate at $2M to $3M.
- O&M: Moderate (accounting, releases, pumping).
- Yield/reliability: Partial—McLellan covers a fraction of demand; augmentation enables flexible physical source.
- Legal feasibility: Medium—purpose/location limitations and augmentation requirements.
- Risks: Infrastructure cost; legal alignment with "municipal/gravel pit augmentation" language. Existing well produces roughly 18 ac-ft/yr. Adding in the additional 16 ac-ft/yr would total 34 ac-ft/yr, which is well short of the 61.5 ac-ft/yr needed to keep the lake full.

Comparison of Options: Table 2

Option	Feasibility	Cost Range	Risks	Long-Term Sustainability
Option 1 Wetland	High	$3M to $4M	New concept has not been vetted	High
Option 2 Resize the Lake	High	$2M to $3M	High capital cost, public perception of smaller lake.	High
Option 3 New Well	Moderate to High	$3M to $4M	High capital cost, water quality, underperformance of the well	Moderate
Option 4 City Ditch	Moderate	$3M to $4M	High capital cost, legal uncertainty	High
Option 5 McLellan Reservoir	Moderate	$2M to $3M	High capital cost, legal uncertainty, supply	Low

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Next Steps

1. **Gain Input from City Council**: Present findings and proposed strategies to city council for feedback and input.
2. **Explore Grant and Funding Options**: Investigate potential funding partners and grant opportunities, including:
    - **SSPRD**: They will need to evaluate any Ketring Lake investments against other capital needs already included in their multi-year capital improvement plan.
    - **ACOS**: They have three primary potential funding paths. Planning grants up to $150K requiring a 10% local match. A standard grant of up to $600K requiring a 25% local match. Both grants have an application deadline of April 10, 2026. The last grant type is a Joint Project Proposal that is considered at any time of the year, which normally requires a greater than 50% match and preferably includes multiple partners.
    - **GOCO**: Community Impact grant applications are highly competitive and open statewide, with an aim for geographic equity. Approximately $8 million is available for local projects in 2026, with an application deadline of mid to late July. Funded projects are generally "shovel ready."
    - **Denver Water**: May partner on a landscape transformation or water-wise project, as we are in their service area, and they have a contractual obligation to "endeavor to continue to supply Ketring Lake."
    - **Private Foundations**: Engage with the Telluray foundation, which typically funds shovel ready projects in the range of $200K.
3. **Conduct Stakeholder Outreach**: Facilitate discussions with community members, stakeholders, and partners to ensure broad support for proposed actions.
4. **Conduct Detailed Feasibility Studies**: Engage engineers and consultants to assess the technical and financial aspects of proposed strategies, including infrastructural needs and costs.

If you have any questions or further suggestions, please let me know.

Thanks.
BRS

ec: Mike Gent, Deputy City Manager
Kathleen Osher, Deputy City Manager
Reid B. Betzing, City Attorney