



# City of Flagstaff City Council Presentation *Biosolids Master Plan*

February 18, 2020



**carollo**  
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# Today's Agenda

- Project Background and Goals
- Condition Assessment of Existing Facilities
- Viable Biosolids Management Strategies
- Capacity Needs at Existing Facilities
- 10-Year Capital Improvement Plan (CIP) Recommendations

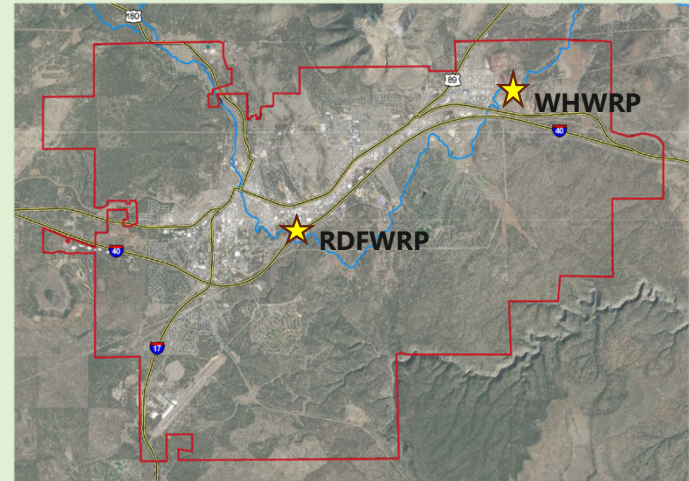


# Project Background and Goals

# Project Background and Goals

## ***General Approach for Flagstaff***

- ☑ Expand portfolio of options for overall biosolids management flexibility and program robustness.
- ☑ Focus on alternatives that are technically and economically viable and reasonable.
- ☑ Develop a program that is sustainable and consistent with City goals.



*RFWRP and WHWRP Location Map*



*Dedicated Land Disposal (DLD) Site at WHWRP*

# Three Main Evaluations Completed in this Master Plan Were Used in the Development of the CIP

- 1 Assess the condition of existing facilities at RDFWRP and WHWRP
- 2 Develop viable biosolids management strategies for the WHWRP
- 3 Estimate existing treatment capacities and identify near-term and buildout capacity needs

# Prioritization of Major Capital Improvement Needs

Priority No.	Project Description	Timing
1	Digester capacity expansion at Wildcat Hill (add 2 digesters)	Immediate
2	Repair & Replacement at Wildcat Hill and Rio De Flag WRPs <ul style="list-style-type: none"> <li>- PEPS capacity expansion and Primary Clarifiers rehabilitation at WHWRP</li> <li>- Secondary Clarifiers weir replacement at Wildcat Hill WRP</li> <li>- Splitter Box rehabilitation at Rio De Flag WRP</li> </ul>	Immediate
3	Additional flow diversion into Rio De Flag WRP	By 2024
4	Mechanical dewatering and solar drying at Wildcat Hill WRP	2025 to 2030
5	New preliminary and primary treatment at Wildcat Hill WRP	2030 to 2035
6	Liquids capacity expansion at Wildcat Hill WRP <ul style="list-style-type: none"> <li>- Option A – Divert Rio De Flag WRP solids out of collection system</li> <li>- Option B – Additional capacity expansion at Wildcat Hill WRP</li> </ul>	By 2032
7	Other Repair & Replacement needs at Wildcat Hill WRP	Varies

Note: Biosolids Projects are highlighted in red



# Condition Assessment of Existing Facilities

# Rio De Flag Water Reclamation Plant – Condition Assessment

WRP COMPONENT	TYPICAL LIFE (YEARS)	RDFWRP COMPONENT AGE (YEARS)	CAPITAL IMPROVEMENT NEEDS
<b>STRUCTURAL CONCRETE</b> <ul style="list-style-type: none"> <li>Unlined</li> <li>Lined/Coated</li> </ul>	20-40 40-60	25 years	<b>Yes</b>
<b>MECHANICAL</b> <ul style="list-style-type: none"> <li>Process Mechanical</li> <li>Pumps</li> <li>Chemical Equipment</li> <li>HVAC</li> <li>Coolers/ACs/Fans</li> <li>Valves and Actuators</li> </ul>	15-25 15-20 10-20 15-25 10-15 30-35	25 years	-
<b>ELECTRICAL</b> <ul style="list-style-type: none"> <li>Generators</li> <li>VFDs</li> <li>Control Panels</li> </ul>	15-20 10-15 25-30	25 years	-
<b>INSTRUMENTATION</b> <ul style="list-style-type: none"> <li>Field Instruments</li> <li>SCADA</li> <li>PLCs</li> </ul>	10-15 10-15 10-15	25 years	-
<b>CIVIL</b>	50-60	25 years	-

Assets at **Rio De Flag WRP** are **25 years old**, Assets in good condition



# Rio De Flag WRP – Condition Assessment Summary



- Majority of the assets have been well-maintained and are generally in good condition.
- However, there are some near-term needs of existing assets, such as the existing Splitter Box rehabilitation.

# Wildcat Hill Water Reclamation Plant – Condition Assessment

WRP COMPONENT	TYPICAL LIFE (YEARS)	WHWRP COMPONENT AGE (YEARS)	CAPITAL IMPROVEMENT NEEDS
<b>STRUCTURAL CONCRETE</b> <ul style="list-style-type: none"> <li>Unlined</li> <li>Lined/Coated</li> </ul>	20-40 40-60	<u>37-47 years old</u> majority of plant	<b>Yes</b>
<b>MECHANICAL</b> <ul style="list-style-type: none"> <li>Process Mechanical</li> <li>Pumps</li> <li>Chemical Equipment</li> <li>HVAC</li> <li>Coolers/ACs/Fans</li> <li>Valves and Actuators</li> </ul>	15-25 15-20 10-20 15-25 10-15 30-35	<u>9 year old</u> IFAS System  <u>28 year old</u> chlorination/ de-chlorination  <u>37-47 years old</u> majority of plant	<b>Yes</b>
<b>ELECTRICAL</b> <ul style="list-style-type: none"> <li>Generators</li> <li>VFDs</li> <li>Control Panels</li> </ul>	15-20 10-15 25-30	<u>37-47 years old</u> majority of plant	<b>Yes</b>
<b>INSTRUMENTATION</b> <ul style="list-style-type: none"> <li>Field Instruments</li> <li>SCADA</li> <li>PLCs</li> </ul>	10-15 10-15 10-15	<u>37-47 years old</u> majority of plant	<b>Yes</b>
<b>CIVIL</b>	50-60		<b>Yes</b>

Majority of the assets at **Wildcat Hill WRP** are in the range of **37-47 years old**, with most of the major basins and equipment at the end of their asset life.

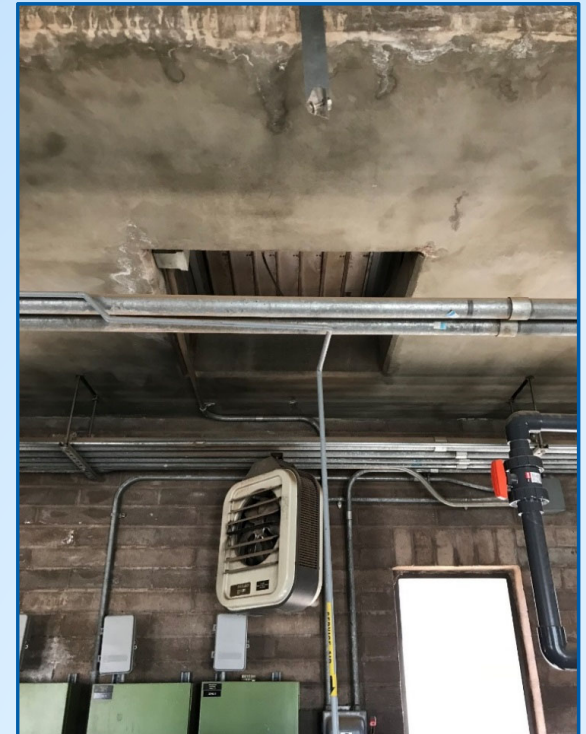
## Critical Issues:

- Code Compliance
- Safety
- Single Points of Failure
- End of Useful Life

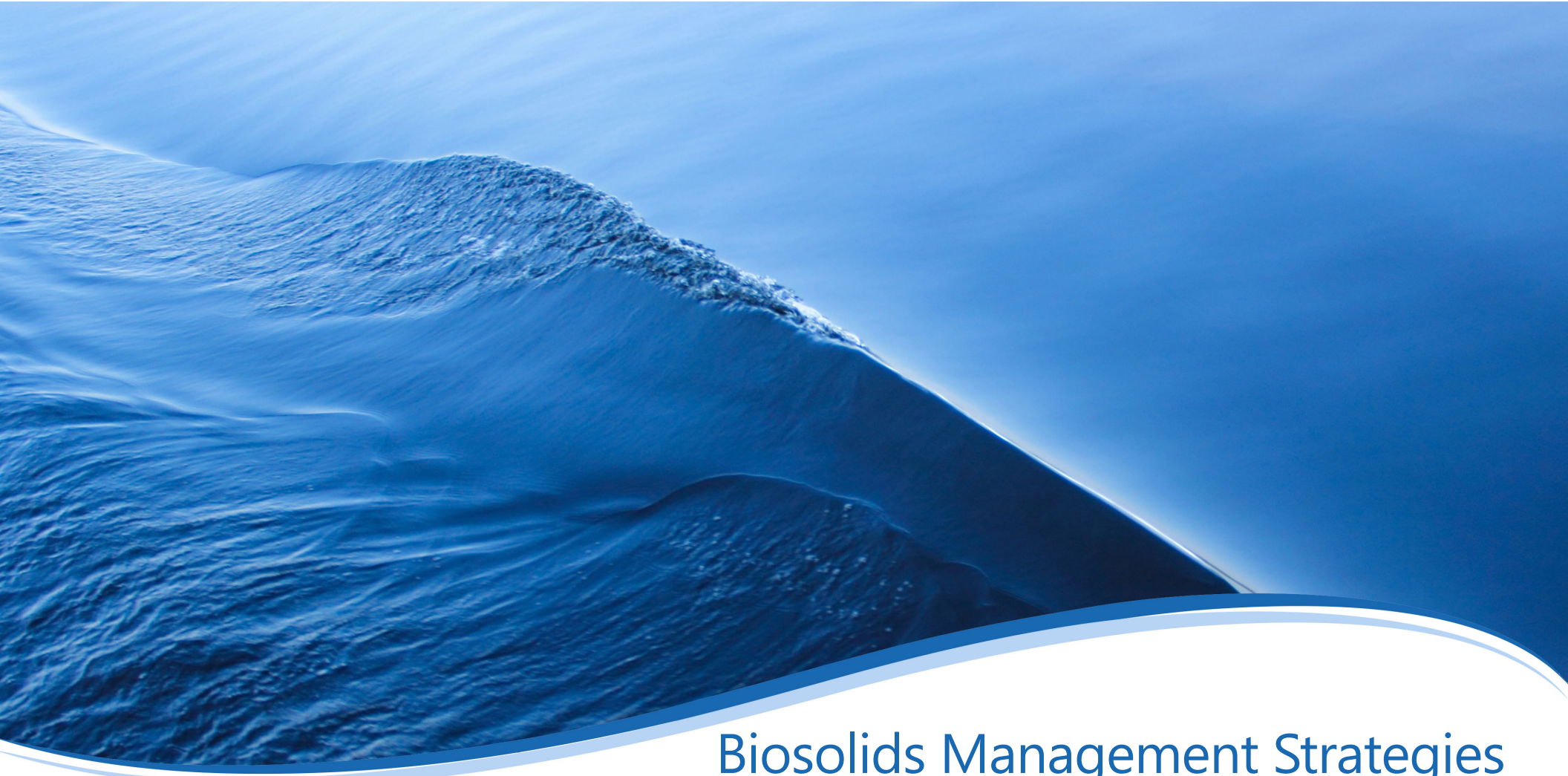
## Primary Effluent Pumps



## Wildcat Hill WRP – Condition Assessment Summary



- Assets are aged further and there are more near-term capital needs.
- Additional mid- to long-term capital needs have also been identified.



# Biosolids Management Strategies for the Wildcat Hill WRP

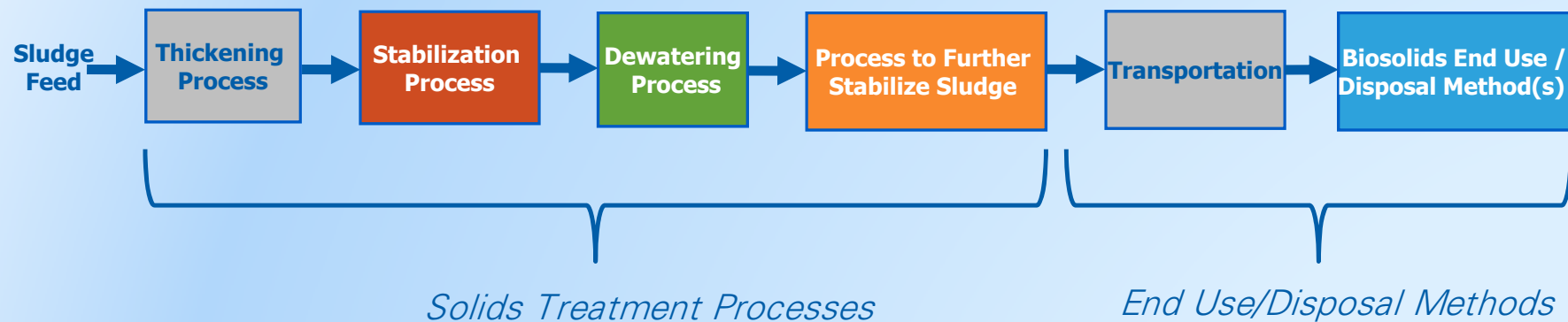
# Existing Biosolids Management Disposal Strategy

- The Class B biosolids produced at the Wildcat Hill WRP is disposed of at the **Dedicated Land Disposal (DLD)** site that is located at the plant.
- **Geotubes** were implemented in 2014 as an interim strategy for 'static dewatering' of biosolids during winter and wet weather conditions.



# A Biosolids Management Strategy Consists of Two Main Components – End Use/Disposal Methods and Solids Treatment Processes

## Biosolids Management Strategy



- Biosolids end use/disposal methods dictate biosolids quality, which in turn impact solids treatment process requirements
- The end use/disposal options provided the overall framework for the evaluation

# What Are the Potential Markets that Exist for the WHWRP Biosolids?

Viable Biosolids End Use / Disposal Option	Cost Impacts	What Quality is Required?	Market Limitations
<b>Dedicated Land Disposal (DLD)</b>	-	Class B	Low
<b>Landfill Disposal</b>	\$	Unclassified Dewatered	Low / Medium
<b>Alternative Daily Cover (ADC)</b>	\$	Class B Dewatered (non-human contact)	Low
<b>Land Application – Class B</b> <ul style="list-style-type: none"> <li>• Agriculture</li> <li>• Forest Lands</li> </ul>	\$\$	Class B Dewatered (non-human contact)	Medium / High
<b>Land Application – Class A</b> <ul style="list-style-type: none"> <li>• Agriculture</li> <li>• Public Parks and Recreation Areas</li> </ul>	\$\$\$	Class A/EQ dewatered, compost, or pellets	Medium
<b>Distribution</b> <ul style="list-style-type: none"> <li>• Garden: Fertilizer</li> <li>• Golf Course</li> </ul>	\$\$\$	Class A/EQ dried pellet	High

# Solids Treatment Processes were Selected for the Wildcat Hill WRP Based on the Preferred Biosolids End Use/Disposal Options

## Summary of Viable Biosolids End Use/Disposal and Solids Treatment Process Options for Flagstaff



**Stabilization Process**

- *Aerobic Digestion*
- **Anaerobic Digestion (2 existing)**
- *Autothermal Thermophilic Aerobic Digestion (ATAD)*
- *Multi-Phase Anaerobic Digestion*
- *Temperature-Phased Anaerobic (TPAD)*

**Dewatering Process**

- **Geotube Bags** (viable near-term)
- **Mechanical Dewatering** (viable long-term)

**Process to Further Stabilize Sludge**

- **No Further Stabilization**
- **Composting**
- **Solar Drying**
- *Air Drying*
- *Thermal Drying*
- *Heat Treatment*
- *Pasteurization*
- *Chemical Addition*
- *Biosolids to Energy / Incineration*

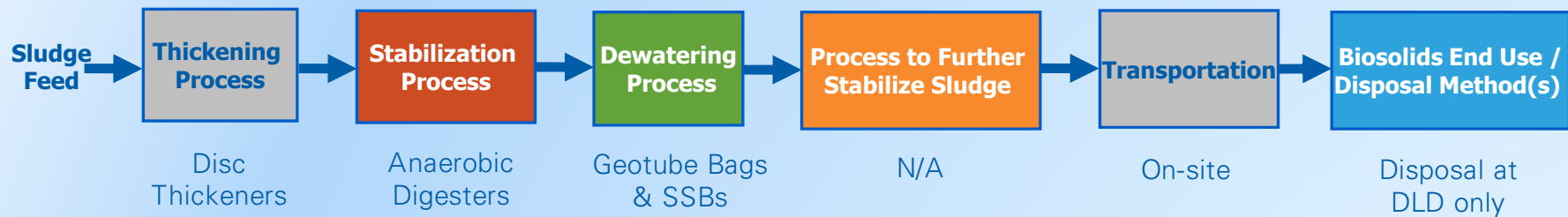
**Biosolids End Use/Disposal Options**

- **Dedicated Land Disposal**
- **Landfill Disposal**
- **Land Application**
- **Landfill Cover**
- **Distribution?**
- **Management Firms?**
- *Fuel Source*
- *Land Reclamation*
- *Construction Materials*

Purple indicates what City does today

# Recommended Near-term Biosolids Management Strategy

## *Anaerobic Digestion plus Geotube Bags (Baseline Option)*



### **Strategy Description**

- Expand Digester Capacity (add 2 more)
- Continue with current solids handling practice
- Produces Class B biosolids for disposal at Dedicated Land Disposal area

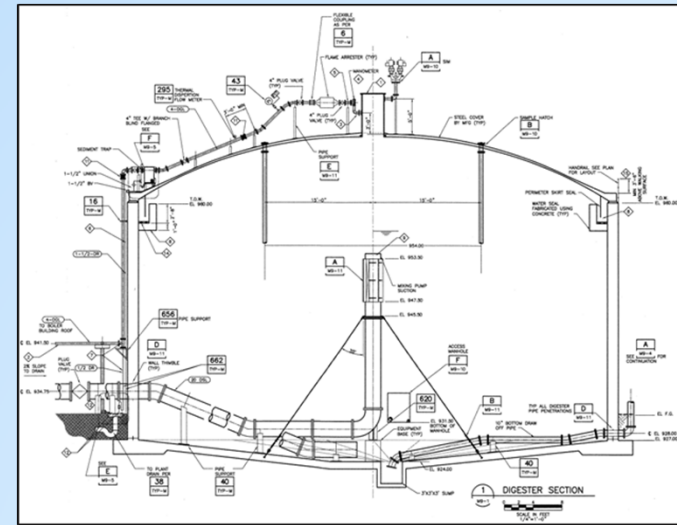
# Solids Treatment Processes

## Biosolids Need #1 – Digester Capacity Expansion at Wildcat Hill WRP

*Timing: Immediate (~\$9.6 million....already funded)*



*Existing Anaerobic Digesters  
at Wildcat Hill WRP*



*Engineering Section of Typical Digester*

### PROS

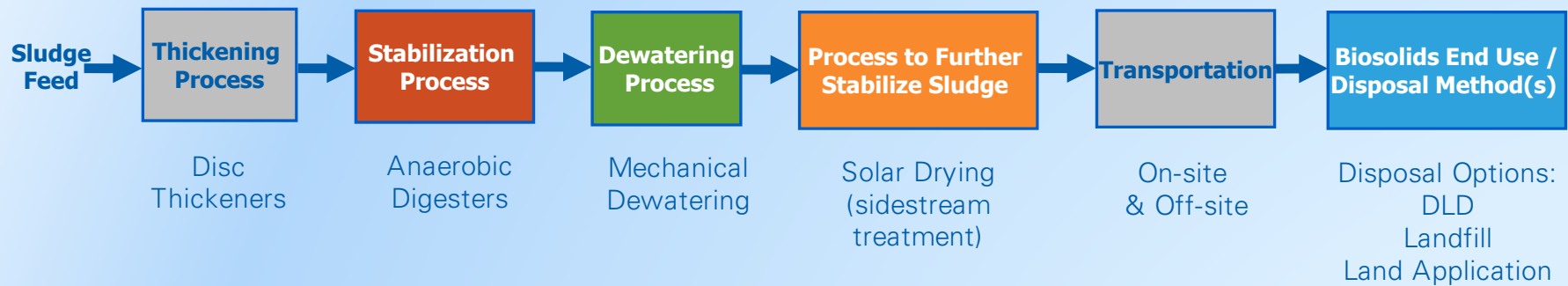
- Lowest cost option for the short-term
- No other major capital improvements required beyond the planned digester expansion (existing facilities still need repair/replacement)

### CONS

- Biosolids are not beneficially reused
- Not a long-term solution
- Disposal at DLD only (limited options)
- Does not produce Class A biosolids

# Recommended Long-term Biosolids Management Strategy

## Anaerobic Digestion plus Dewatering plus Solar Drying

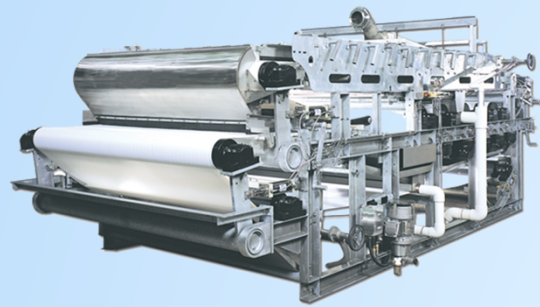


### Strategy Description

- Add mechanical dewatering
- Consider adding Solar Drying a percentage of dewatered biosolids for the production of some Class A biosolids
- Produces dewatered Class B and Class A biosolids for flexibility

# Solids Treatment Processes

## Biosolids Need #2 – Add Mechanical Dewatering at Wildcat Hill WRP



### PROS

- Provides benefits for DLD operation
- Allows beneficial reuse of the biosolids

### CONS

- Higher cost option (compared to baseline)
- Increased hauling costs

# Solids Treatment Processes

## Biosolids Need #3 – Solar Drying at Wildcat Hill



*A dry product allows the City flexibility in biosolids disposal and reuse*



*Solar Drying Greenhouses*

### PROS

- Biosolids are beneficially reused
- Relatively low cost, long-term option for the production of Class A biosolids
- Allows for a broad range of disposal options
- Compatible with existing digestion facility

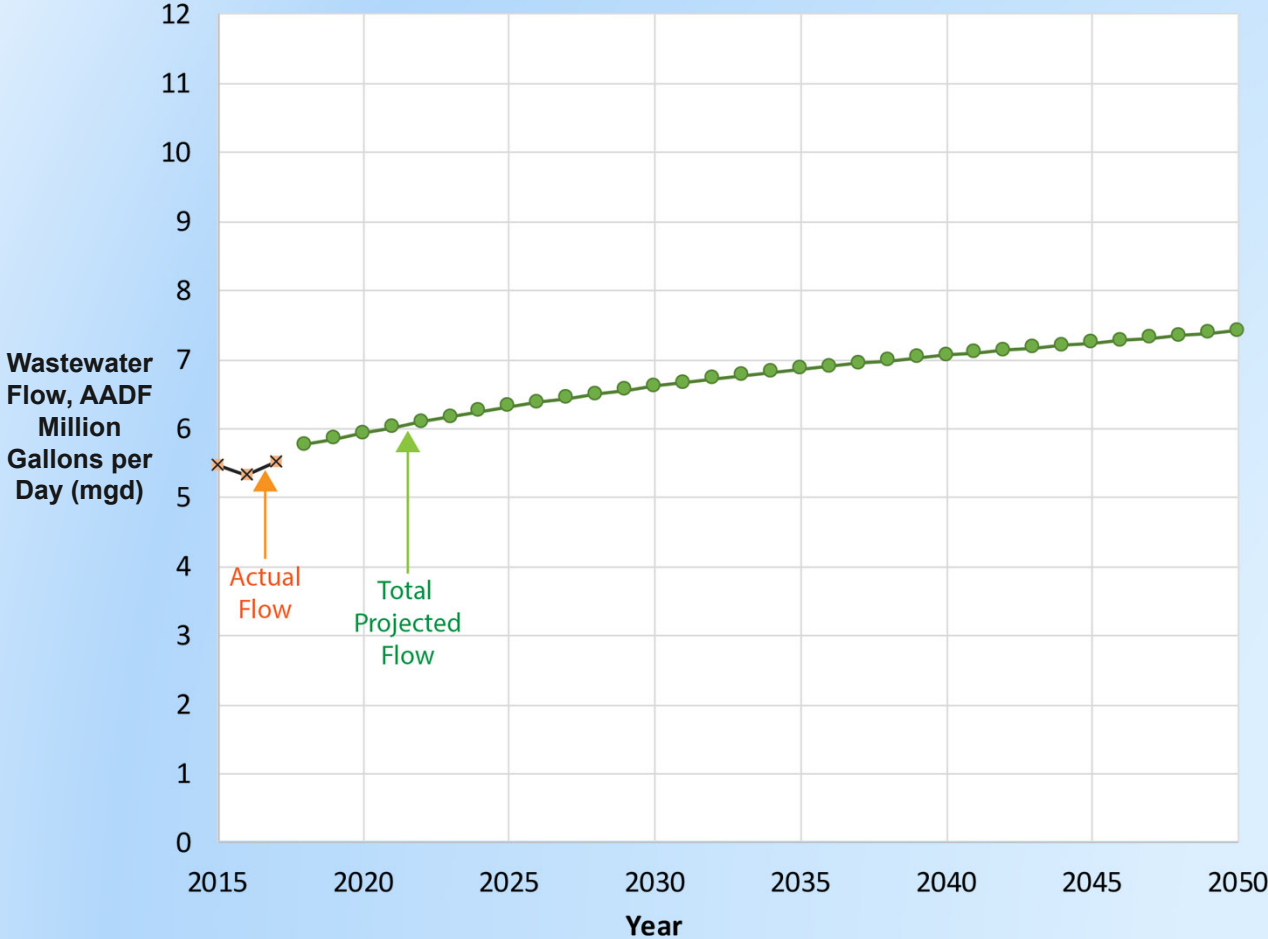
### CONS

- Solar drying is a land-intensive process
- Higher cost option (compared to baseline)
- Increased hauling costs



# Liquids Capacity Needs at WHWRP and RDFWRP

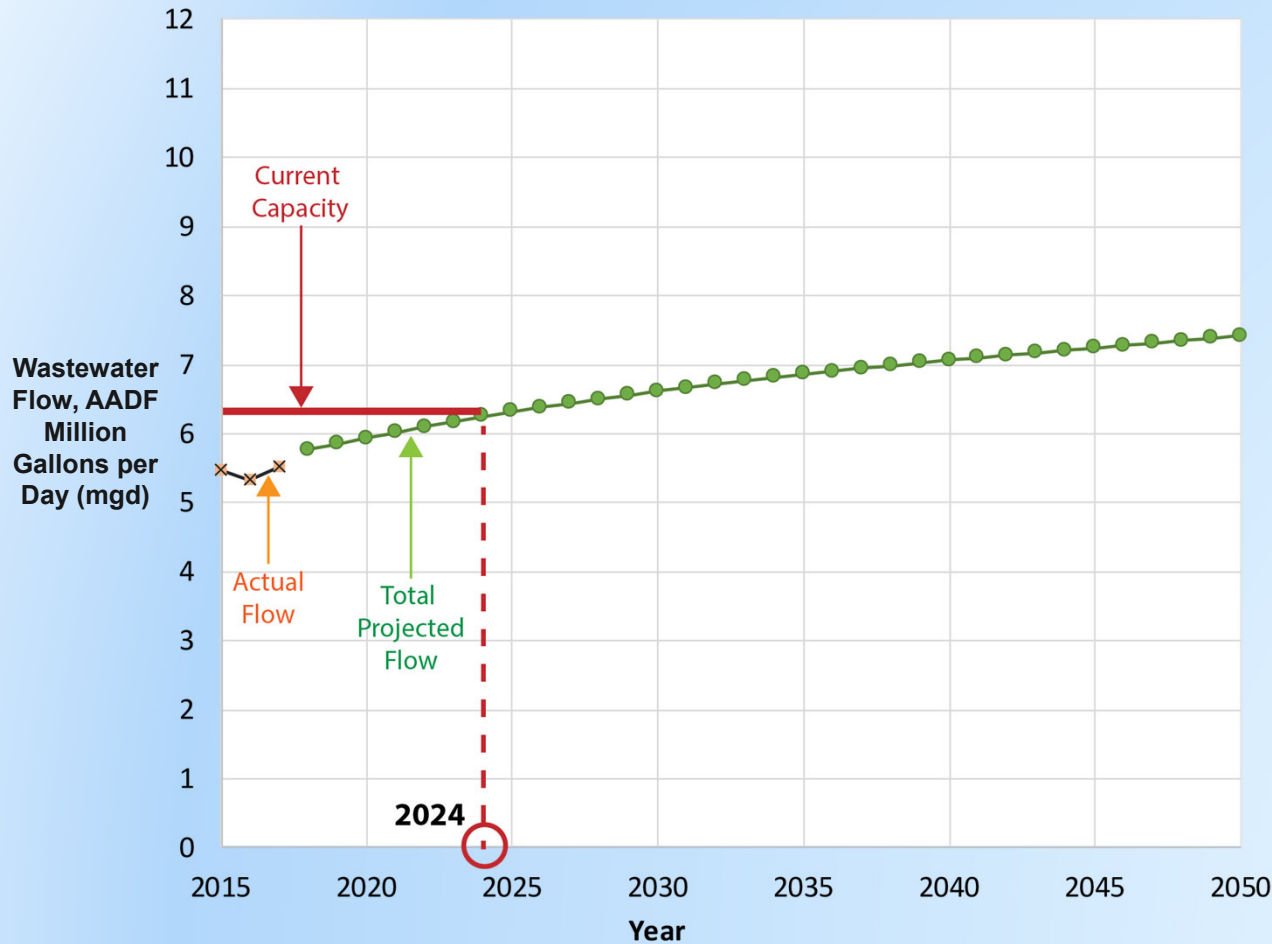
# Liquids Capacity – Evaluation



- Wastewater flow projections were developed for the City based on population projections and per capita wastewater production.

# Liquids Capacity – Current Operation

*Rio De Flag WRP operating at 2 mgd (solids sent to Wildcat Hill WRP via sewer)*



- Under current conditions, the wastewater treatment capacity of **6.3 mgd** is expected to be reached by **year 2024**.

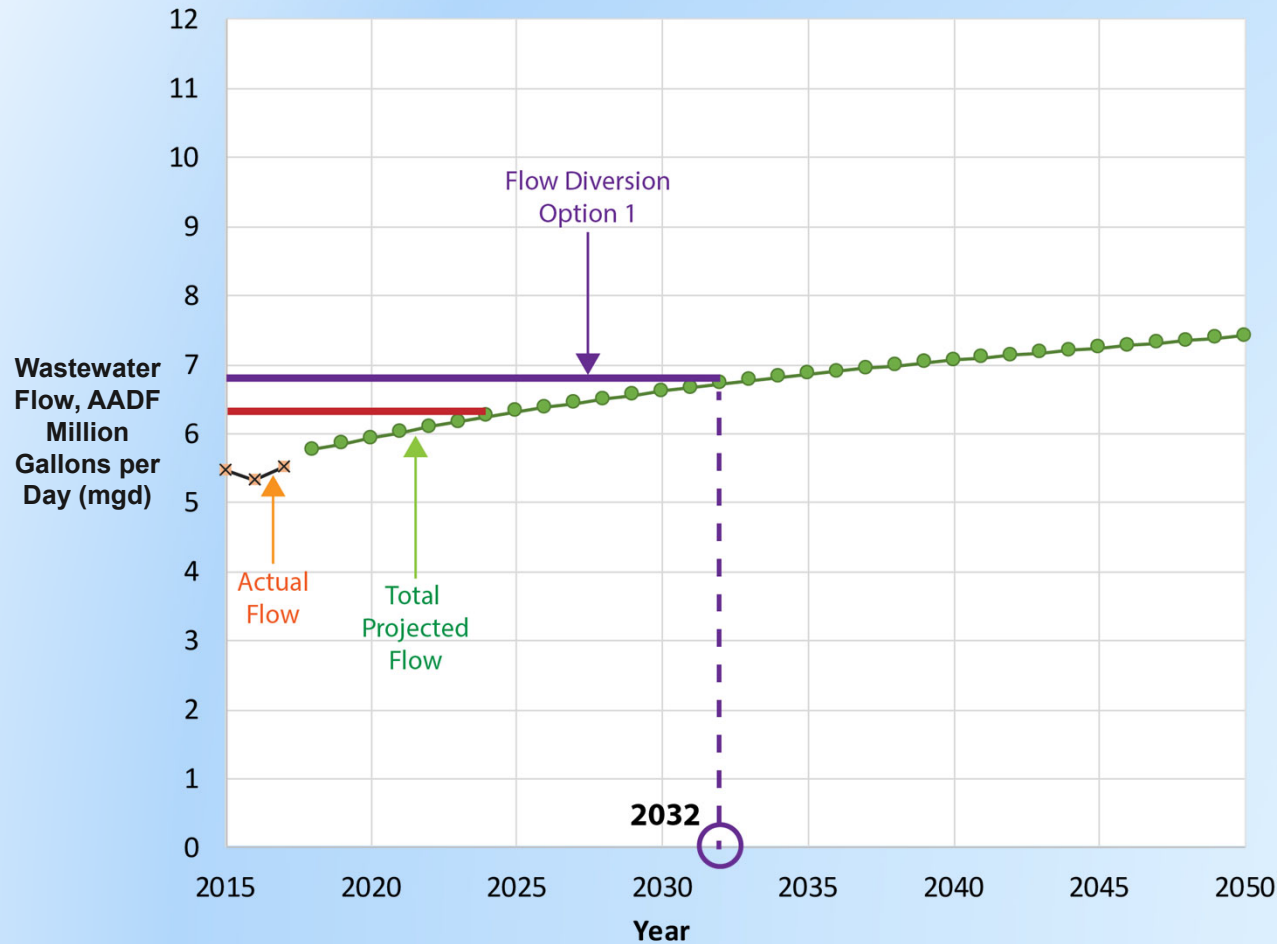
- At that time, additional liquid capacity would be needed at WHWRP

OR

- Alternately, more flow may be diverted into the RDFWRP

# Liquids Capacity – Flow Diversion Option 1

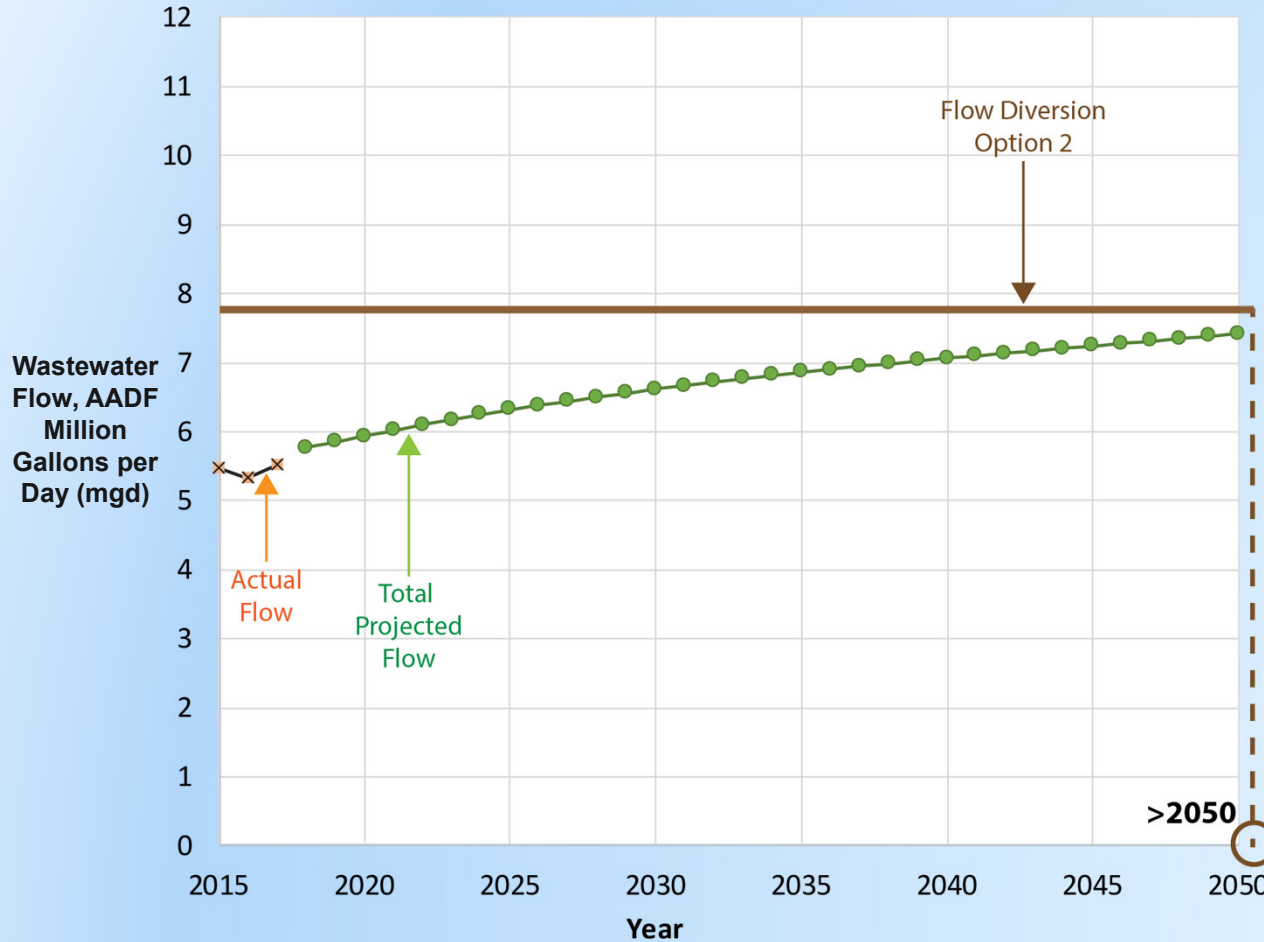
*Rio De Flag WRP at 3.3 mgd (solids sent to Wildcat Hill WRP via sewer)*



- If the Rio De Flag WRP is operated at its maximum capacity of **3.3 mgd**, while still sending the solids to Wildcat Hill via the sewer....
- Then no new plant capacity is needed until **year 2032**.
- Currently, it is unknown if the Rio De Flag WRP can increase its inflow to 3.3 mgd. Additional information is needed.

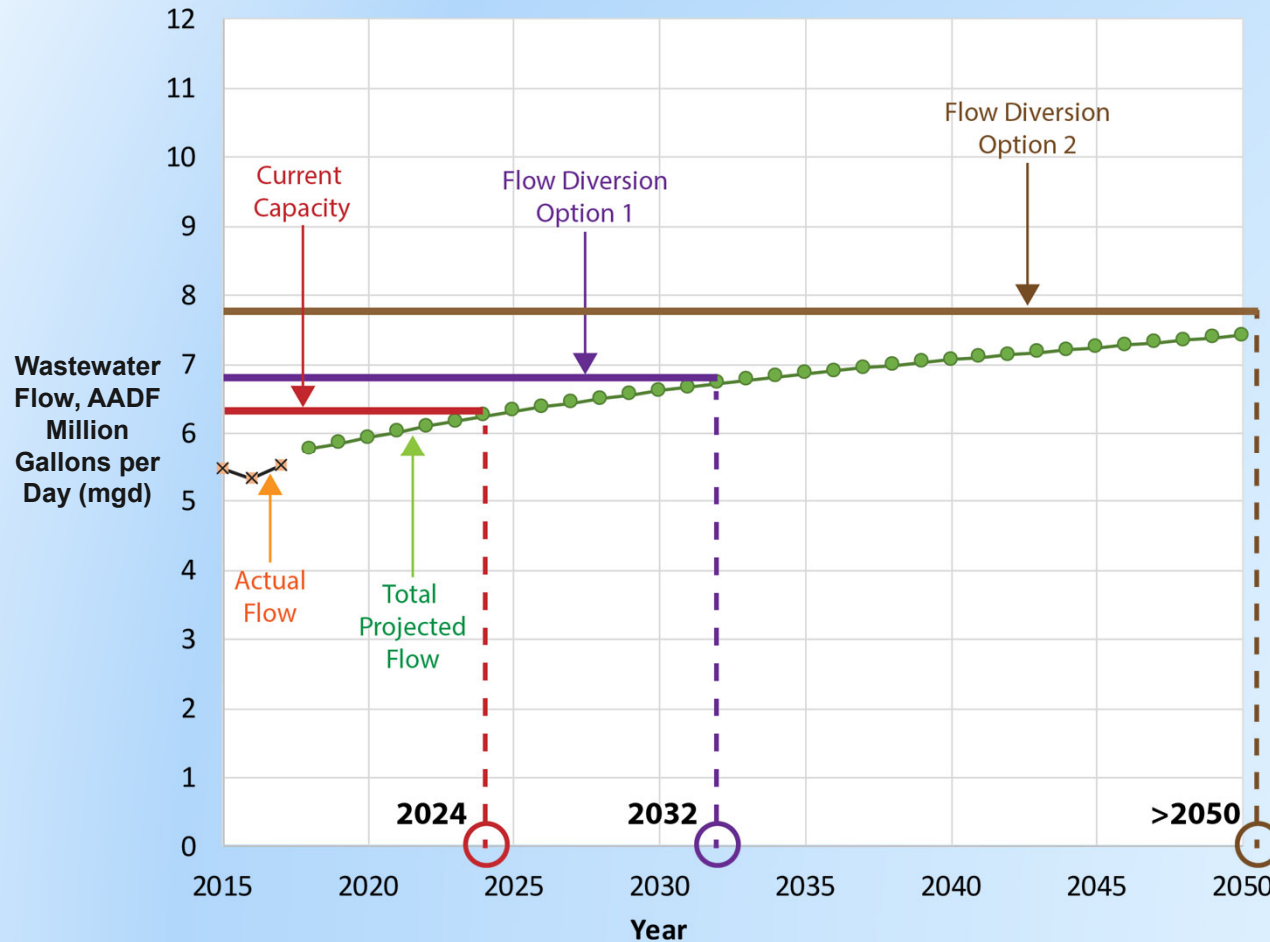
## Liquids Capacity – Flow Diversion Option 2

*Rio De Flag WRP at 3.3 mgd (solids thickened & trucked to Wildcat Hill WRP)*



- If Rio De Flag WRP is operated at its maximum capacity of 3.3 mgd and solids are trucked or conveyed outside the collection system to Wildcat Hill WRP (i.e. thickened and hauled)....
- Then the total combined treatment capacity will be sufficient until after year 2050.

# Liquids Capacity – Summary and Recommendations



- 1) Recommend investigating when Rio De Flag WRP can intake more flow (in lieu of expanding Wildcat Hill WRP treatment capacity).
- 2) Recommend investigating when to modify solids handling at Rio De Flag WRP to ultimately thicken and haul solids directly to the Wildcat Hill WRP digesters; develop costs, odor control, community education/ outreach



# Summary and Capital Improvement Plan Recommendations

# SUMMARY

- Condition Assessment of Existing Facilities
  - **Rio De Flag WRP:** most assets in good condition, continue with repair & replacement
  - **Wildcat Hill WRP:** most assets beyond useful life. Immediate capital needs
- Viable Biosolids Management Strategies (Wildcat Hill WRP)
  - **Immediate:** expand digester capacity (add 2 more digesters)...already funded. Continue to use Dedicated Land Disposal area
  - **Long-Term:** add mechanical dewatering, consider solar drying for Class A biosolids, investigate new uses such as alternative landfill cover, etc.

# SUMMARY

- Liquid Capacity at Existing Facilities
  - **Rio De Flag WRP:** immediately investigate if Rio can increase inflows by 2024 or additional capacity at Wildcat Hill WRP will be needed. Investigate trucking solids to Wildcat Hill WRP by 2032 or expand capacity at Wildcat Hill WRP
  - **Wildcat Hill WRP:** none needed until after 2050 if above can be accomplished

# Prioritization of Major Capital Improvement Needs

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1	Digester capacity expansion at Wildcat Hill (add 2 digesters)	Immediate
2	Repair & Replacement at Wildcat Hill and Rio De Flag WRPs <ul style="list-style-type: none"> <li>- PEPS capacity expansion and Primary Clarifiers rehabilitation at WHWRP</li> <li>- Secondary Clarifiers weir replacement at Wildcat Hill WRP</li> <li>- Splitter Box rehabilitation at Rio De Flag WRP</li> </ul>	Immediate
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7	Other Repair & Replacement needs at Wildcat Hill WRP	Varies

Note: Biosolids Projects are highlighted in red



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February 18, 2020

## QUESTIONS?

Brian Bernard, P.E.  
Chad Meyer, P.E.  
Russ Wachter, P.E.

The logo for Carollo, featuring the word "carollo" in a stylized, lowercase font with a blue swoosh above the "c". Below the name is the tagline "Engineers...Working Wonders With Water.®".  
**carollo**  
Engineers...Working Wonders With Water.®