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Technical Memorandum T-52

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Technical Memorandum T-52

Subject: Capital Improvements Plan

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Limitations:

Section 1: Introduction

The City of Nampa (City) is evaluating alternatives to manage its wastewater discharge to address increasingly stringent water quality regulations, aging infrastructure, and growth within the City. Upgrades to the Nampa Wastewater Treatment Plant (WWTP) are needed to meet the requirements of these drivers. The purpose of this technical memorandum (TM) is to document the initial implementation approach and potential capital improvements plans for the Preferred Alternative based on the outcomes of *TM T-47 Liquids Stream Alternatives BCE, TM T-51 Biosolids End Use Alternatives BCE*, and *TM T-50 Existing Asset Investment Evaluation*.

The City has elected to use a phased approach to constructing upgrades at the Nampa WWTP, which was initially described in *TM T-01 Nampa WWTP Phasing Recommendations*. Building on these initial recommendations, this TM includes several discussions relevant to the phased delivery of the needed upgrades to the Nampa WWTP including project phasing, project packaging, project delivery methods, programmatic contingency development, and the capital improvements plans presentation. Several of these discussions are included to document the current understanding of the conditions for use in future phases of project delivery. Others, such as the programmatic contingency and capital improvements plan, will provide the foundation from which the City's Wastewater Program will be further developed

Section 2: Preferred Alternative for Nampa WWTP Upgrades

The City's facility planning process evaluated needed upgrades for the Nampa WWTP to meet the demands associated with increasingly stringent water quality regulations, aging infrastructure, and growth within the City. These were evaluated in several TMs including *TM T-47 Liquids Stream Alternatives BCE, TM T-51 Biosolids End Use Alternatives BCE*, and *TM T-50 Existing Asset Investment Evaluation*. Each of these TMs recommended capital improvements at the Nampa WWTP. In combination, these upgrades represent the Preferred Alternative for upgrades to the Nampa WWTP and constitute approximately $135M in capital costs.

The Preferred Alternative (Figure 1) includes the following projects at the Nampa WWTP:

- Repair the Headworks process equipment and heating, ventilating, and air conditioning (HVAC) system
- Repair the Primary Clarifier 1 structure, mechanism, and sludge pumps
- Repair Primary Clarifiers' 2 and 3 mechanisms
- Repair primary effluent pump station pumps 1, 2, and 3
- Construct Aeration Basin #4
- Install internal mixed liquor recycle pumps and piping
- Construct a new Blower Building
- Replace Final Clarifiers' 1, 2, and 3 mechanisms
- Construct Final Clarifier #4
- Replace return activated sludge (RAS) Pumps 1, 2, 3, and 4
- Replace the waste activated sludge (WAS) Pumps and RAS Piping

- Construct a sidestream struvite treatment process
- Construct a tertiary filtration system including a pump station
- Construct an ultraviolet disinfection system to meet Class A recycled water standards
- Construct an effluent pump station and forcemain to convey Class A recycled water to industrial users
- Construct an effluent pump station and forcemain to convey Class A recycled water to irrigation users
- Replace the Post Aeration Basin Process including structure and blower
- Construct primary sludge thickening
- Construct Primary Digester #5 and the corresponding relocation of the waste gas burner
- Expand the Solids Handling Facility
- Construct a new Laboratory Building with additional administrative space
- Repair Primary Sludge Pumps 1, 2, and 3
- Repair Primary Digester #1
- Repair Digester Mixing Pumps 1, 2, and 3
- Repair Digester Recirculation Pumps 3 and 4
- Replace motor control centers (MCCs) 1A, 1B, 4, 6, 7, and 10

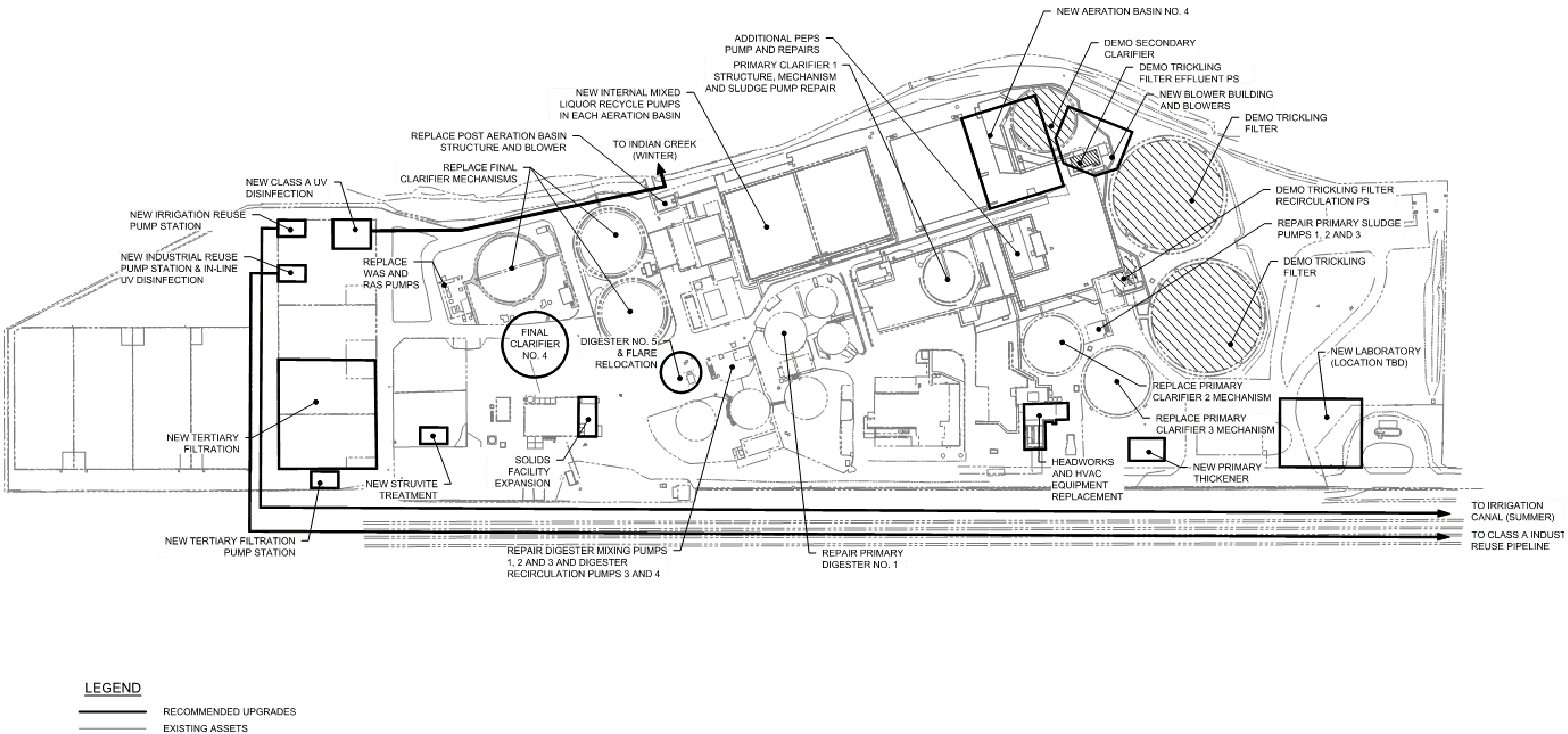

Figure 1. Preferred alternative

Section 3: Project Phasing

The *Liquids Stream Alternatives Business Case Evaluation* (BCE) showed Alternatives 2 and 2.5 as the lowest cost alternatives for meeting the City's objectives and critical success factors. Subsequent discussions with the Nampa City Council directed the team to pursue the development of a recycled water program with the intent to reuse as much water as possible. The Preferred Alternative discussed in Section 2 represents the capital improvements needed for this approach.

Many of the upgrades associated with the Preferred Alternative are needed to meet the City's final effluent total phosphorus limit, which becomes effective in 2026. However, the impetus for creating the full recycled water program is the new effluent temperature limit, which does not become effective until 2031. Acknowledging that there are potential benefits with developing the recycled water program early given the interest from the potential irrigation users, the City was interested in evaluating the preferred project phasing approach, which is described in the following sections

3.1 Problem Statement

How should the upgrades at the Nampa WWTP to develop a recycled water program be phased?

3.2 Current and Projected Condition

The current and projected conditions are consistent with those presented in *TM T-47 Liquids Stream Alternatives BCE.*

3.3 Alternatives

Two project phasing options were considered as part of this evaluation.

3.3.1 Option 1: Phase II Upgrades Only

Under Option 1, all the upgrades recommended in *TM T-47 Liquids Stream Alternatives BCE* would be implemented by 2026, in what is known as the Phase II Upgrades. This timeline would allow for the full recycled water program to be implemented by this time.

3.3.2 Option 2: Phase II and Phase III Upgrades

Under Option 2, only the upgrades needed to meet the final effluent total phosphorus limit would be completed by 2026 (Phase II). Following the Phase II Upgrades, the pump stations, pipelines, and conversion to total nitrogen removal needed to support the full recycled water program would be constructed by 2031, in what is known as the Phase III Upgrades.

3.4 Alternatives Screening

Both alternative capital delivery approaches were considered viable and thus evaluated further in the BCE.

3.5 Comparative Analysis

The comparative analysis compares the net present value (NPV) for each project phasing option. This analysis accounts for both capital and operating and maintenance costs as well as the risk and benefit costs associated with each option.

3.5.1 Capital Costs

Capital cost estimates and assumptions for Alternative 2.5 are documented in *TM T-47 Liquids Stream Alternatives BCE.* The total capital cost of Option 1 and Option 2 are identical at $120.9M; however, the timing of capital costs is impacted by the escalation rate (4.94 percent) and discount rate (2.80 percent). Option 1 assumes that all capital upgrades are completed by 2026, whereas Option 2 includes a third delivery phase for fully developing the recycled water program, which accounts for approximately $11.9M in capital improvements.

3.5.1.1 Operation and Maintenance

Operation and maintenance estimates and assumptions for Alternative 2.5 are documented in *TM T-47 Liquids Stream Alternatives BCE.* Due to the timing of each option, these costs differ over the analysis period because fewer facilities are operating under Option 2 for 5 years (2026–2031). The total operation and maintenance cost of each option, using an analysis period of 2018–2040 is:

- Option 1 = $152.3M
- Option 2 = $149.3M

3.5.2 Risk

The majority of the risks evaluated as part of TM T-47 are equally applicable to Options 1 and 2 and are thus not considered as part of this evaluation. One risk between options remains differential: the risk of the initial contract with the canal company for discharging Class A water. During development of the *Liquids Stream BCE*, the team estimated the risk of not being able to negotiate the initial contract as 50 percent. This risk would apply to Option 2 only, and its consequence would be constructing a temperature mitigation system. The capital and annual operation and maintenance cost of the temperature mitigation system are $15.5M and $1.1M, respectively. This risk is detailed in Table 1.

Table 1. Risk Summary

Risks	Description	Consequence	Assumptions	Probability	Cost	Timing
Unable to negotiate initial contract with canal company	Delay in constructing pipeline and pump station to convey flow to irrigation canal results in a failed negotiation with canal company to accept Class A water	Construct temperature mitigation system involving chillers and cooling towers to meet National Pollutant Discharge Elimination System (NPDES) permit requirements	Capital cost: $15.5M Annual operation and maintenance costs: $1.1M	50%	Capital: $7.8M Operation and maintenance: $550k	Capital cost from 2026–2031 Annual cost from 2031–2040

The total risk cost for each option, using an analysis period of 2018–2040, follows:

- Option 1 = $0
- Option 2 = $13.3M

3.5.3 Benefits

There is little difference in benefits between Options 1 and 2 due to the timing of Class A water for irrigation reuse and the value it represents. The total volume during a 6-month period is approximately 8,960 acre-feet. The current water rental rate is $17 per acre-foot based on available information provided by the Idaho Water Resources Board for the Water Supply Bank and equates to an annual benefit cost of approximately $152,000 for the irrigation reuse portion of this benefit cost.

The likelihood that this benefit cost will be realized is assumed to increase over time as water becomes scarcer in the Treasure Valley. The probability profiles for the additional water assets benefit are therefore 5-, 10-, and 15-percent. The additional water assets benefit cost timing for the industrial reuse component is 2026, 2031, and 2036 for Option 1. The additional water assets benefit cost timing for the industrial reuse component is 2031, 2036, and 2041 for Option 2.

The total benefit costs of each option, using an analysis period of 2018–2040, follows:

- Option 1 = $5.3M
- Option 2 = $5.1M

3.5.4 Summary

A summary of the NPV results from the BCE is provided in Table 2. The BCE results indicate Option 1 as the lowest cost of asset ownership, which is primarily driven by the risks associated with delaying negotiations with the irrigation district for Option 2.

Table 2. BCE Total Net Present Value Summary

Alternative	Capital Costs	O&M Costs	Risk Costs	Benefit Costs	NPV
Option 1: Phase II Upgrades Only	$120.9M	$152.3M	$0	$5.3 M	($343.4 M)
Option 2: Phase II and Phase III Upgrades	$120.9M	$149.3M	$13.3M	$5.1 M	($359.0 M)

O&M = operation and maintenance.

3.5.5 Sensitivity Analysis

The results are highly sensitive to the risk of the initial contracting and its likelihood to occur. If this risk is assigned a likelihood greater than 6 percent, Option 1 remains favored over Option 2. However, if the likelihood is less than 6 percent, the result changes and Option 2 is favored over Option 1. Table 3 shows the BCE results with the risk of initial contracting set at 6 percent.

Table 3. BCE Total Net Present Value Summary

Alternative	Capital Costs	O&M Costs	Risk Costs	Benefit Costs	NPV
Option 1: Phase II and Phase III by 2026	$120.9M	$152.3M	$0	$5.3 M	($343.4 M)
Option 2: Phase II by 2026 and Phase III by 2031	$120.9M	$149.3M	$1.6M	$5.1 M	($343.3 M)

Further evaluation of funding approaches is required to determine whether Option 1 or Option 2 will be the Preferred Approach. The City may elect to fund a portion of the needed upgrades through debt such as a bond or State Revolving Fund loan, which would relieve some of the upward pressure on rates for Option 1 and may assist in developing the full recycled water program earlier. Therefore, capital improvement plans for each scenario are shown in Section 5.

Section 4: Project Packaging Considerations

The Preferred Alternative represents an investment of approximately $135M in the Nampa WWTP. The following section describes considerations for packaging and delivery methods for the Preferred Alternative. The main purpose of this discussion is to highlight considerations that should be carried forward to the preliminary design phase, which is when the preferred project packaging will be decided.

4.1 Project Packaging Constraints

The team evaluated the pros/cons of several packaging options for delivering the Preferred Alternative. These options will be further refined during development of the Preliminary Engineering Report from 2018 to 2019 as equipment/process selections are performed and precise funding mechanisms are known. The following section describes the packaging constraints applicable to the Preferred Alternative including technical, schedule, market conditions, financial capacity, and organizational capacity.

4.1.1 Technical Constraints

Technical constraints define the boundaries of project packaging to maintain Nampa WWTP hydraulic and treatment capacity during construction. These constraints also account for spatial limitations (e.g., a new process cannot be placed over an existing process until it is removed). The following bullets describe known technical constraints:

- Site layout
  - Demolishing Secondary Clarifier, trickling filter effluent pump station, and Trickling Filter #1 needs to occur prior to constructing the new Blower Building and Aeration Basin #4.
- Hydraulic
  - The Filter Pump Station will set the hydraulic grade line for both tertiary and disinfection processes. This pump station should be designed in conjunction with these processes to reduce the risk of hydraulic limitations; coordination between the construction of these facilities will also be needed.
- Treatment
  - Primary Clarifier #1 rehabilitation should occur before taking Primary Clarifiers #2 or #3 offline for mechanism replacements.
  - The new Blower Building should be constructed prior to or in parallel with Aeration Basin #4 to provide aeration to the new basin.
  - Internal Mixed Liquor Recycle Pumps are needed prior to discharging to the irrigation canal to achieve sufficient nitrogen removal.
  - RAS pumping and the new RAS pipeline should occur with or prior to Aeration Basin #4 construction.
  - Final Clarifier #4 should be constructed before replacing existing mechanisms for Final Clarifiers #1 through #3 to maintain overall clarifier capacity.
  - Tertiary Filtration could increase solids production by approximately 10 percent. This increase could impact the timing of solids facility expansion specifically related to centrifuges.
  - Digester #5 construction should occur before Digester #1 rehabilitation occurs (the unit would be offline during construction) in order to not limit the overall digester hydraulic retention time.

4.1.2 Schedule Constraints

Schedule constraints define the impact to sequencing project packages and elements to meet known schedule requirements and activity durations. The following bullets show known schedule constraints:

- Provide Idaho Department of Environmental Quality (IDEQ) preliminary schedule for meeting permit limits by December 31, 2022.
- Meet final total phosphorus limits by August 31, 2026.
- Meet final effluent temperature limits by August 31, 2031.

4.1.3 Market Conditions

Nampa and the Treasure Valley are projected to have several large construction projects within and outside the wastewater sector. These projects include major expansions at the City of Meridian Water Reclamation Facility, City of Boise Lander Street Water Renewal Facility, and City of Boise West Boise Water Renewal Facility. In addition to these regional wastewater treatment projects, a new water treatment plant and transmission pipeline are planned for the Mountain Home Air Force Base. Collectively, these projects have the potential to reduce the availability of qualified local contractors to perform the Preferred Alternative. The following factors may influence cost and quality of Nampa WWTP projects:

- **Bidder's climate.** The more simultaneous projects in the region, the higher the cost of construction, particularly for trade crafts. This demand could lead to higher bid and change order prices on projects.
- **Quality of contractors.** Quality regional contractors may be committed to other projects potentially leading to situations where available contractors are less familiar with the work and local market labor to meet desired construction schedule.
- **Trades availability.** Electricians, pipefitters, plumbers, and carpenters could be limited resources with limited availability, and labor costs could increase or result in inexperienced workers.
- **Contracting package sizes.** There is a delicate balance to the package size (dollar value) of a construction project and contracting requirements. If the value is too large, it can preclude firms unable to meet bonding requirements. If the value is too small, the benefits of construction efficiency may not be obtained.
- **Local participation.** The City has a good history of working with local contractors in the Treasure Valley and is successfully completing Phase I Upgrades using these local firms. It is important to the City to maintain these relationships, so contracts should be packaged in a manner that allows them to compete effectively.

4.1.4 Financial Capacity Constraints

The City has historically used a mix of cash- and debt-funding for improvements at the Nampa WWTP. The City is currently evaluating funding options for the Phase II/III Upgrades including rates, bonds, and debt financing. The ultimate funding method selected will impact the feasibility of certain delivery approaches. For example, cash-funding improvements requires that projects be packaged and sequenced such that the spending does not exceed the City's ability to generate revenue. Debt financing of the improvements largely removes these constraints but requires additional early effort to allow the City to take on debt.

4.1.5 Organizational Capacity Constraints

Lastly, the capacity of an organization to successfully procure, execute, and manage multiple projects is a key consideration to project packaging. The City has retained a Program Manager, Brown and Caldwell (BC), to manage the delivery of the Phase II and Phase III Upgrades. This structure reduces but does not eliminate the demands on internal City resources. The following organizational capacity considerations are applicable when considering project delivery methods:

- Operation and maintenance staff can support a limited number of concurrent projects. Multiple, concurrent projects increase stresses to maintain plant operations during construction. For example, assuming one 4-hr workshop per month during construction for five concurrent projects is approximately 15 percent of a full-time employee in meetings alone. The commitment is likely to be 1–1.5 full-time employees during heavy design and construction periods. The efficiency of staff time is improved with fewer contracts.
- Contractor procurement cannot be performed in parallel with other activities within design-bid-build delivery methods, which increases the project duration. Also, a limited number of concurrent procurements can be conducted to solicit qualified bidders and evaluate responses.

Based on these constraints, Table 4 shows their applicability to the Phase II and III Upgrades and the City. As previously noted, project packaging will be further refined during the development of the Preliminary Engineering Report.

	Table 4. Number of Contract Packages			
Constraint	1–2	3–4	5–6	6+
Technical	• Meeting site layout and hydraulic and treatment constraints requires close coordination with designer and contractor. • Risk of process failures is partially transferred to contractor. • Fewer conflicts on-site with fewer contractors.	• Creates a logical set of packages based on process area (e.g., liquids, solids, tertiary, and repair and replacement projects). • Risk of process failures are managed through sequencing packages. • Potential for contractor conflicts on-site greater than 1–2 package scenario.	• Creates a logical set of packages based on process area (e.g., liquids, solids, tertiary, and repair and replacement projects). • Risk of process failures are managed through sequencing packages. • Potential for contractor conflicts on-site greater than 3–4 package scenario.	• Greatest risk of on-site contractor conflicts and staging challenges. Risk would need to be mitigated by staging projects. • City owns more coordination risk between packages.
Schedule	• Potentially longest design duration due to the number of project elements under one contract. • Least control of project schedule during construction. • Greatest opportunity to coordinate multiple construction processes.	• Design duration may be shortened through parallel activities. • Increased control of construction schedule over 1–2 packages by sequencing efforts. • Coordination and construction sequencing efficiencies possible but less than 1–2 package scenario.	• Design duration can be shortened through parallel activities but unlikely to be shorter than 3–4 package scenario. • Increased control of construction schedule over 1–2 packages by sequencing efforts. • Coordination and construction sequencing efficiencies limited.	• Most control of schedule by sequencing design and construction packages. • Least opportunity for innovative approaches and coordination between multiple process elements.
Market conditions	• Lower opportunity for competition and ability to select multiple contractors. • Large contract packages may limit involvement of local engineering and construction companies.	• Design/Construction packages would be approximately $35–$45M each, which limits number of local firms but offers a greater opportunity than 1–2 packages. • Large contract packages may limit involvement of local engineering and construction companies.	• Design/Construction packages would be approximately $25–$30M each. However, some projects may be significantly smaller than others (e.g., repair and replacement projects vs. tertiary process).	• Fewest limitations on contractors able to bid and best opportunity for local construction. Design/Construction packages would be approximately $25M each or less. • Most opportunity for qualified local firms with experience constructing projects of this value. • May not be enough qualified firms for this many projects.
Financial capacity	• Least flexibility once project bidding has occurred (assuming Design-Bid-Build delivery method). • Likely best price because contractor can optimize across multiple process/site elements. Contractor able to organize work by trade.	• Some flexibility based on project packaging and sequencing. • Packages are large enough to encourage competition and allow for construction efficiencies.	• Some flexibility based on project packaging and sequencing. • Packages are large enough to encourage competition and allow for construction efficiencies. • Packages fit within IDEQ funding capabilities.	• Most flexibility by sequencing work to fit financial limitations and changes. • Likely highest price because fewest construction efficiencies can be obtained.
Organizational capacity	• Fewer internal resources needed to manage fewer contractors/designers. • Least number of procurements required reduces project schedule.	• More resources needed to manage contractors/designers but similar to Phase I project efforts.	• Increases number of internal and external resources to manage multiple contractors and designers concurrently.	• Most number of internal and external resources to manage multiple contractors and designers concurrently. • Most number of procurements required.

4.2 Project Delivery Options

The City has historically delivered projects at the Nampa WWTP using a design-bid-build delivery method. Alternative delivery approaches may be warranted given the size and complexity of the Phase II and Phase III Upgrades. Figure 2 shows the typical contractual relationship between the owner (City of Nampa), engineer, and contractor as well as several pros and cons of each method. The delivery method and packaging approach work in concert with one another but can be selected independently from one another. For example, the City could choose to a deliver a single very large ($100+ million) project using design-bid-build, multiple smaller projects ($20–$30 million each) using construction manager/general contractor methods, or a combination thereof. The decision on delivery method(s) will be determined during the Preliminary Engineering Phase in 2018/2019.

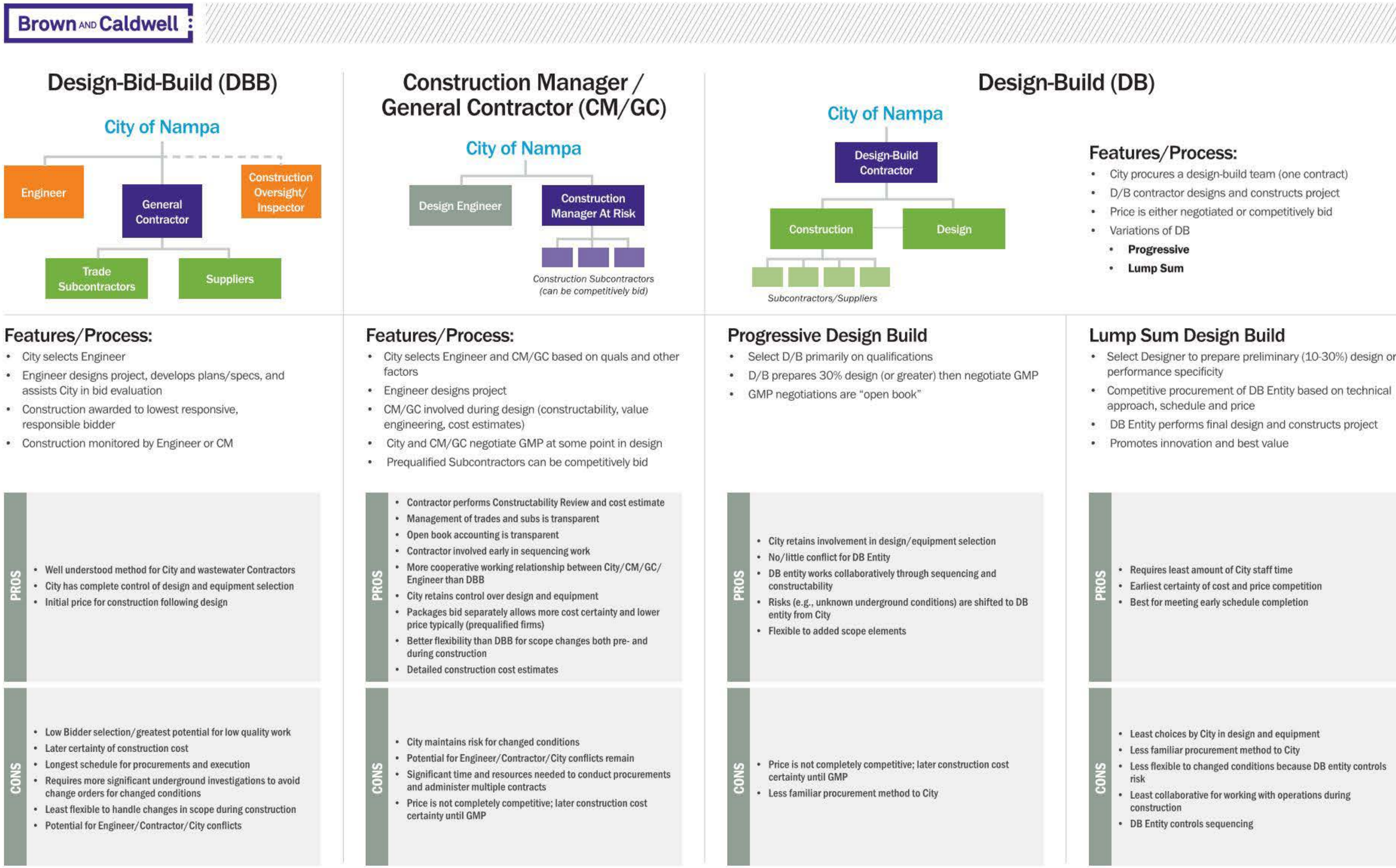

Figure 2. Delivery methods

Section 5: Nampa Wastewater Program Delivery Plan

The following sections describe the expected costs and schedule for delivery of the Preferred Alternative as part of the Nampa Wastewater Program

5.1 Program Costs

The cost of the overall implementation of the Preferred Alternative can be captured in two categories: known costs (capital cost estimates) and unknown costs that may occur during program delivery (programmatic contingency). Each of these costs are described in the following sections.

5.1.1 Preferred Alternatives Capital Costs

The capital costs for the Preferred Alternative have been previously described in *TM T-47 Liquids Stream Alternatives BCE, TM T-51 Biosolids End Use Alternatives BCE*, and *TM T-50 Existing Asset Investment Evaluation*. These costs are summarized in Table 5 for clarity.

Table 5. Preferred Alternative Capital Cost Summary	
Actions	Capital Cost
Repair the Headworks process equipment, HVAC system, and replace MCCs 1 and 1A	$2,493,000
Repair the Primary Clarifier 1 structure, mechanism, and sludge pumps	$1,302,000
Repair Primary Clarifiers' 2 and 3 mechanisms	$174,000
Repair Primary Effluent Pump Station pumps	$228,000
Construct Aeration Basin #4	$8,316,000
Install internal mixed liquor recycle pumps and piping	$2,758,000
Construct a new Blower Building	$13,019,000
Replace Final Clarifiers' 1, 2, and 3 mechanisms	$1,454,000
Construct Final Clarifier #4	$5,689,000
Replace RAS Pumps 1, 2, 3, and 4	$344,000
Replace the WAS Pumps and RAS Piping	$363,000
Construct a sidestream struvite treatment process	$8,751,000
Construct a tertiary filtration system including a pump station	$38,197,000
Construct an ultraviolet disinfection system to meet Class A recycled water standards	$8,457,000
Construct an effluent pump station and forcemain to convey Class A recycled water to industrial users	$3,725,000
Construct an effluent pump station and forcemain to convey Class A recycled water to irrigation users	$9,161,000
Replace the Post Aeration Basin Process including structure and blower	$2,405,000
Construct primary sludge thickening	$9,153,000
Construct Primary Digester #5 and the corresponding relocation of the waste gas burner	$9,100,000
Expand the Solids Handling Facility	$4,187,000
Construct a new Laboratory Building with additional administrative space	$2,525,000
Repair Primary Sludge Pumps 1, 2, and 3	$48,000
Repair Primary Digester #1	$550,000
Repair Digester Mixing Pumps 1, 2, and 3	$66,000
Repair Digester Recirculation Pumps 3 and 4	$44,000
Replace MCCs 4, 6, 7, and 10	$2,140,000
Replace MCC 2B1	$535,000
Replace washer/compactor	$68,000
TOTAL	**$135,252,000**

5.1.2 Long-Term Capital Plan

The Preferred Alternative represents the needed investments at the Nampa WWTP until 2031. It encompasses upgrades needed to address changing regulatory conditions, repair aging assets, and provide capacity for further residential, commercial, and industrial growth. Beyond 2031, additional investments will be needed to maintain the expected level of service for the Nampa WWTP. These future upgrades will be needed to address potential future regulatory changes, continue investment in aging assets, and further expand capacity.

5.1.2.1 Future Regulatory Requirements

The *Liquids Stream Alternatives BCE* (TM T-47) identified a risk for the Preferred Alternative related to the regulation of additional constituents for surface water discharge. This risk encompasses the potential need for addressing either microconstituents (such as endocrine disrupting compounds, pharmaceuticals, and personal care products) or decreased metals limits (such as mercury, cyanide, and/or copper). The regulation of additional surface water constituents was assumed to require the construction of an ozonation system to achieve compliance with future permit limits with the capital cost for this system estimated at $41,032,000. Further, the analysis in TM T-47 estimated a risk probability of 80 percent for these limits to be implemented by 2041, which would require the construction of this system within this capital planning horizon. For the purposes of capital planning, it is assumed that an ozonation system will be required by 2040 to meet future regulatory requirements. Therefore, the capital costs for this system have been included in the capital improvements plan between 2036 and 2040 (see Section 5.3). The timing and approach to these upgrades should be further evaluated if and when these future regulations are enacted.

5.1.2.2 Future Capacity Requirements

The Preferred Alternative includes needed capacity improvements to achieve the 2040 flow and loading projections as described in *TM T-46 Nampa Wastewater Flow and Loading Projections.* However, further capacity expansion may be required between 2040 and 2045. Annual flow and loading projections have not been prepared for this period due to the availability of population projections. Therefore, as a conservative assumption for capital planning, the construction of potential upgrades needed within the period have been included between 2036 and 2040. It is projected that these upgrades will include replacing the Influent Pump Station ($4.3M), adding Primary Digester #6 along with associated upgrades to the digester feed system ($9.1M), and constructing Final Clarifier #5 ($5.7M). In total, these upgrades represent an investment of $19.1M between 2036 and 2040.

5.1.2.3 Repair and Replacement Funding

To maintain ongoing process functions within the Nampa WWTP, the City will need to continually fund rehabilitation and repair projects to maintain the current level of service and meet customer expectations. The Phase II and III Upgrades will significantly increase the replacement value of the Nampa WWTP; therefore, additional funding should be set aside to plan for future needs. The team estimated the amount of funding needed for the future repair and replacement projects using the following assumptions:

- The total capital cost of Phase II and III Upgrades is estimated to be $120.86 million including markups, nearly doubling the replacement value of the Nampa WWTP.
  - Structures and equipment that are part of the Phase II Upgrades have varied estimated lives. Based on the structures and types of equipment associated with these Upgrades, the team made the following assumptions regarding estimated life:
    - Structures (e.g., buildings, clarifiers, pipelines): 50 years
    - Specialized equipment (e.g., UV equipment, blowers, struvite process): 15 years
    - Standard equipment (e.g., pumps): 20 years
  - The annual replacement value was estimated by taking 1 divided by the estimated useful life multiplied by the capital cost including markups. For example, the construction of Aeration Basin #4 has an estimated capital cost of $8.32M and is predominately structural with an estimated life of 50 years. Therefore, the annual replacement value is 1/50 times $8.32 million, which equals $166,000 per year. For processes that contained multiple asset categories (i.e., structural and standard equipment), the capital cost was proportioned based on each category and multiplied by its applicable estimated life.

  - The annual replacement value of new assets in the Phase II Upgrades is approximately $5.5 million, which equates to an annual renewal rate of approximately 4.6 percent per year. This rate results in an average renewal of these assets at 17 years.
- The Phase II and III Upgrades contain a similar distribution of asset types to the existing Nampa WWTP including structures, specialized equipment, and standard equipment; therefore, the same annual replacement percentage can be applied to the existing Nampa WWTP Phase I Upgrades to estimate the annual replacement value.

The ongoing repair and replacement funding represents the average annual expenditures that will be needed to maintain the performance and condition of the Nampa WWTP. Assuming a 4.6 percent renewal rate for assets (average expected useful life of approximately 17 years), this corresponds to an annual investment of $5.7M once the Preferred Alternative is fully implemented. The City has elected to begin funding this reinvestment in 2026 starting at $2.5M with annual increases in funding until full implementation is reached in 2035. Unlike projects noted in TM T-50, the planned improvements related to these expenditures have not been determined. The implementation of the ongoing asset management program described in *TM T-45 Nampa Wastewater Treatment Plant Existing Asset Evaluation* would identify the projects to be completed with this funding.

5.1.3 Programmatic Contingency

Programmatic contingency provides flexibility for capital programs during the design and construction phases to address unplanned work. There are several standard methods for developing a programmatic contingency including percentage of total capital estimates (10–30 percent), risk register, and lessons learned from past projects. The goal of a programmatic contingency fund remains the same: ensure adequate funding for Phase II and III Upgrades that is reliable and sufficient to complete the planned work.

The team decided to use a risk register approach to develop the programmatic contingency. A risk register is a summary of relevant project risks that have the potential to add costs to a project. There are two primary components of each risk in a risk register: likelihood and consequence. Likelihood is assigned a percentage based on current and historical understanding of how likely that risk will occur. Consequence is the monitory value that risk would have if it occurs to the project. By multiplying the likelihood and consequence, the risk to the project can be quantified. In this circumstance, this risk is called the programmatic contingency. At a workshop held on September 12, 2017, the City and BC brainstormed an initial risk register and estimated programmatic contingency.

The risk register is split into five categories including Process, Regulatory, Repair and Replacement, Construction, and Policy. The purpose of categorizing each risk is to aid in determining its timing and possible mitigation strategies. For example, the risk of locating underground utilities and conflicts may increase overall construction costs by 10 percent; this risk is likely to occur during construction and is an accepted risk. Given these conditions, this risk is likely to result in an amount of program contingency to mitigate the cost. Alternatively, the risk of changes in state, federal, or landfill requirements for biosolids could change resulting in significant cost increases. This risk is outside the City's control and is acceptable risk but likely unfunded through programmatic contingency. Most risks add costs to the overall project budget to account for potential events that may occur during the project. Some risks are "negative risk" values because they would represent benefits and cost savings to the project. For example, an increase in the discharge allowed for total phosphorus would result in a less costly technology to meet the requirements and reduce the capital cost of the program. These potential benefits have been accounted for in the preliminary risk register as well.

Table 6 shows the preliminary risk register that served as the basis for the programmatic contingency estimate. The table shows each risk, its potential impact (consequence), likelihood, risk strategy, and whether the risk is funded or unfunded. The programmatic contingency needed for Phase II and Phase III Upgrades is $15,488,000 and $151,000, respectively. The total programmatic contingency needed is $15,639,000.

Table 6. Programmatic Contingency Estimate

Risk Overview	Impact	Probability	Adjusted Risk Value	Timing	Category	Risk Strategy	Funded Contingency	Mitigation Strategy
Additional wastewater characterization data or peaking factor leads to lower capacity than expected	$8,316,000	5%	$415,800	Phase II	Process	Accept–funded	$415,800	
Changes in The Amalgamated Sugar Company discharges result in need for additional carbon. (Reduce only carbon and not total Kjeldahl nitrogen)	$500,000	25%	$125,000	Phase II	Process	Accept–funded	$125,000	
Opportunity to buy remaining capacity from Simplot to offset need for capital improvements related to flow	$20,000,000	40%	-$8,000,000	Phase II	Process	Accept–funded	-$8,000,000	
Reduction in total nitrogen requirement for recycled water to 30 milligrams per liter total nitrogen	-$2,758,000	10%	-$275,800	Phase III	Regulatory	Accept–funded	-$275,800	
Reduction in total phosphorus requirement for discharge to 0.35 milligrams per liter year-round	-$21,398,000	5%	-$1,069,900	Phase II	Regulatory	Accept–funded	-$1,069,900	
Changes in NPDES permit results in need for additional unit processes	$41,032,000	1%	$410,320	Phase III	Regulatory	Accept–funded	$410,320	
Inability to obtain recycled water permit results in need to build temperature facilities	$15,596,000	5%	$779,800	Phase III	Regulatory	Mitigate	$0	Project phasing will be planned around negotiations with the IDEQ and Pioneer.
Changes in state, federal, or landfill requirements for Class B biosolids disposal result in implementing Class A	$25,225,000	2%	$504,500	Phase III	Regulatory	Accept–unfunded	$0	
Issues identified during design require that Headworks is replaced (rather than equipment repaired)	$18,211,000	10%	$1,821,100	Phase II	Repair & replacement	Accept–funded	$1,821,100	
Issues identified during design require that Primary Clarifier #1 is replaced (rather than repaired)	$4,073,000	25%	$1,018,250	Phase II	Repair & replacement	Accept–funded	$1,018,250	
Issues identified during design require that Post Aeration Basin is replaced (rather than repaired)	$2,530,000	10%	$253,000	Phase II	Repair & replacement	Accept–funded	$253,000	
Issues identified during design require that Primary Sludge Pumps 1, 2, and 3 are replaced (rather than repaired)	$140,000	5%	$7,000	Phase III	Repair & replacement	Accept–funded	$7,000	
Issues identified during design require that Digester Mixing Pumps 1, 2, and 3 are replaced (rather than repaired)	$192,000	5%	$9,600	Phase III	Repair & replacement	Accept–funded	$9,600	
Owner-requested changes (outside of current project scope) result in 10% increase in overall project price	$13,500,000	30%	$4,050,600	Phase II	Construction	Accept–funded	$4,050,600	
Underground utilities and conflicts increase overall construction costs by 10% (based on Project Group A data)	$13,500,000	25%	$3,375,000	Phase II	Construction	Accept–funded	$3,375,000	
Weather, construction sequencing, or other factors lengthen schedule and result in violations of NPDES permit	$450,000	5%	$22,500	Phase II	Construction	Mitigate	$0	Project sequencing will be considered throughout design process to limit risk. Also, potentially addressed through delivery approach.
NPDES permit violations during construction as a result of process upsets, industrial inputs, construction sequencing, or other factors	$75,000	5%	$3,750	Phase II	Construction	Mitigate	$0	Project sequencing will be considered throughout design process to limit risk. Also, potentially addressed through delivery approach.
Bidding climate (i.e., availability of trades, availability of general contractors, etc.) at time of bid results in bid prices that are 10% higher than expected	$40,500,000	25%	$10,125,000	Phase II	Construction	Accept–funded	$10,125,000	
Delay in funding decision, delay in design schedule, or City-caused delays results in shortened project schedule increasing overall project cost by 10%	$13,500,000	25%	$3,375,000	Phase II	Policy	Accept–funded	$3,375,000	
						Phase II Upgrades Contingency	$15,488,000	
						Phase III Upgrades Contingency	$151,000	
						TOTAL CONTINGENCY	$15,639,000	

5.2 Preliminary Program Schedule

Nampa has elected to use a phased approach to needed upgrades at the Nampa WWTP. Many of the upgrades associated with the Preferred Alternative are needed to meet the City's final effluent total phosphorus limit, which becomes effective in 2026. However, the impetus for the creation of the full recycled water program is the new effluent temperature limit, which does not become effective until 2031. As noted in Section 3, the City may elect to construct the Preferred Alternative exclusively through the Phase II Upgrades, which would eliminate the need for the Phase III Upgrades.

Figure 3 shows the preliminary project schedule for implementing the Preferred Alternative through the Phase II and III Upgrades to the Nampa WWTP. For each phase, it is expected that the overall implementation will require approximately 8 years from the start of the preliminary design phase through the completion of construction and start-up. The actual schedule will be further developed based on the selected project delivery and packaging approaches.

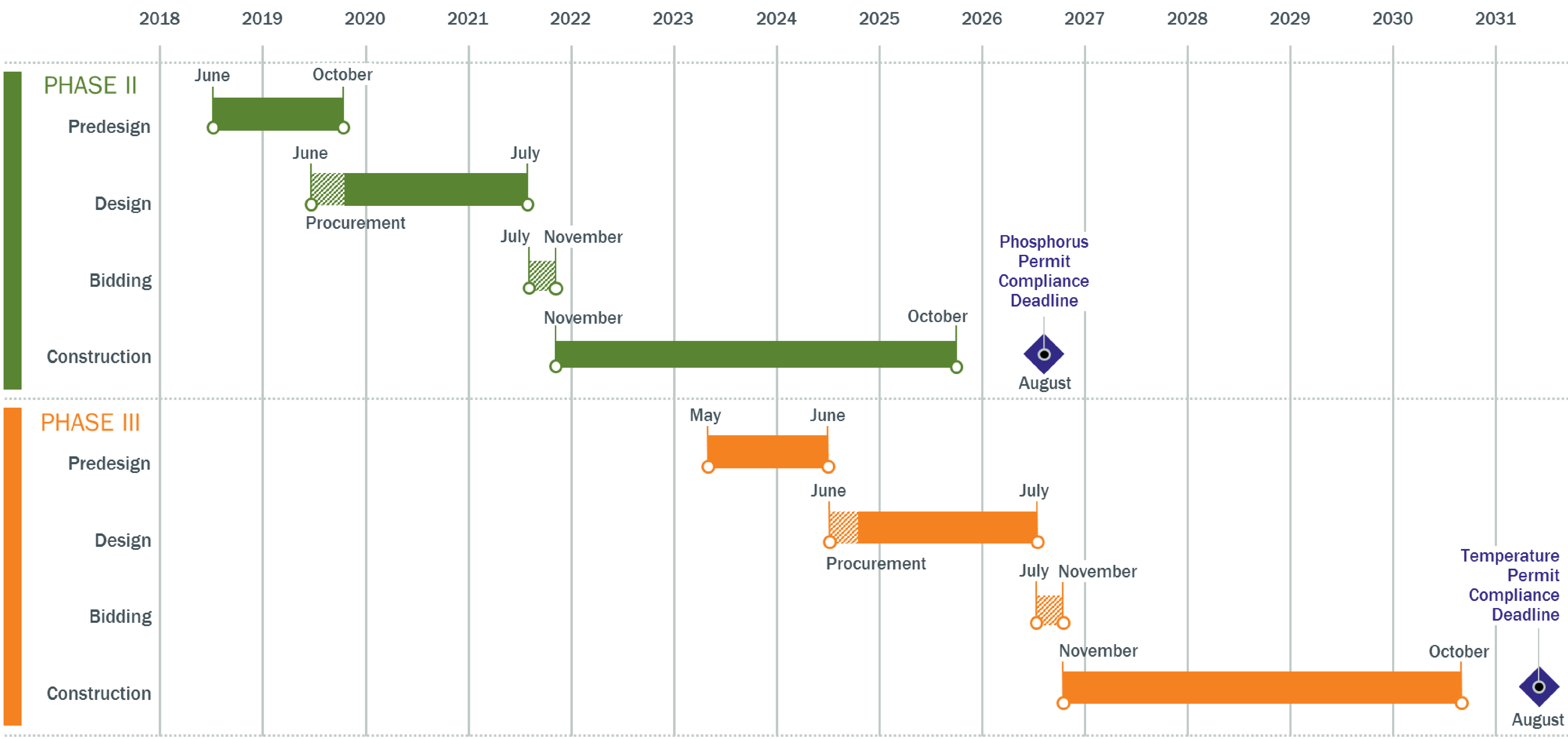

Figure 3. Preferred alternative delivery schedule

5.3 Capital Improvements Plan

The Preferred Alternative (Section 5.1.1.) is composed of investments to meet increasingly stringent regulatory requirements, repair or replace gaining infrastructure, and accommodate future residential, commercial, and industrial growth. A programmatic contingency has also been established based on the potential risks that may be experienced during the implementation of the Preferred Alternative (Section 5.1.3). Additionally, future investments at the Nampa WWTP are expected to address future regulatory requirements (Section 5.1.2.1.), provide future capacity (Section 5.1.2.2.), and provide for the systematic investment in the assets at the Nampa WWTP (Section 5.1.2.3.). In combination, these investments represent the expected capital improvements for the Nampa WWTP between 2018 and 2040.

Two capital improvements plans have been prepared for the Nampa WWTP. As noted in Section 3, the approach to project phasing is largely dependent on the risks associated with delayed implementation of discharge to an irrigation canal. These risks will be better understood as the City negotiates the specifics of this approach with an irrigation district. Therefore, a capital improvements plan has been prepared for both project phasing alternatives considered in Section 3. Table 7 shows Phase II and III Upgrades constructed simultaneously from 2018–2025, whereas Table 8 shows Phase II and III Upgrades separated but still meeting the City's NPDES requirements. More detailed project sequence and duration estimates for these projects will occur during the Preliminary Engineering phase. Projects in Phase II and III Upgrades are expected to have a 5–8-year project duration encompassing Preliminary Engineering, Final Design, Procurement, Construction, and Commissioning/Start-Up.

Implementing the capital improvements will also increase the operating costs for the Nampa WWTP. While these costs are not included in Tables 7 or 8 because they are not capital investments, it is important that these costs be captured in future City budgeting. The incremental increase in annual operating costs resulting from implementing the Preferred Alternative is $4.48M after the completion of the Phase II Upgrades and $0.16M after the completion of the Phase III Upgrades (total of $4.64M).

Table 7. Capital Improvements Plan: Early Capital Scenario (2017 dollars, in millions)

Project	FY2018	FY2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FYs 2031–2035	FYs 2036–2040	Total
Phase II	$1.27	$2.54	$7.16	$5.37	$23.15	$23.15	$23.15	$23.15	$0	$0	$0	$0	$0	$0	$0	$108.94
Phase III	$0.14	$0.28	$0.78	$0.59	$2.53	$2.53	$2.53	$2.53	$0	$0	$0	$0	$0	$0	$0	$11.91
Repair and rehab	$0.13	$0.27	$0.75	$0.56	$3.21	$2.92	$2.41	$2.41	$0	$0.52	$0.04	$0	$0	$0.55	$0.60	$14.37
Programmatic contingency	$0	$0	$0	$0	$15.64	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$15.64
Future regulatory requirements	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$41.03	$41.03
Future capacity expansion	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$19.06	$19.06
Repair and replacement funding	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.51	$2.85	$3.19	$3.53	$3.87	$24.45	$27.80	$68.20
Total	$1.54	$3.09	$8.69	$6.52	$44.53	$28.60	$28.09	$28.09	$2.51	$3.37	$3.23	$3.53	$3.87	$25.00	$88.49	$279.15

Table 8. Capital Improvements Plan: Late Capital Scenario (2017 dollars, in millions)

Project	FY2018	FY2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FYs 2031–2035	FYs 2036–2040	Total
Phase II	$1.27	$2.54	$7.16	$5.37	$23.15	$23.15	$23.15	$23.15	$0	$0	$0	$0	$0	$0	$0	$108.94
Phase III	$0	$0	$0	$0	$0.00	$0.14	$0.28	$0.78	$0.59	$2.53	$2.53	$2.53	$2.53	$0.00	$0.00	$11.91
Repair and rehab	$0.13	$0.27	$0.75	$0.56	$3.21	$2.92	$2.41	$2.41	$0	$0.52	$0.04	$0	$0	$0.55	$0.60	$14.37
Programmatic contingency	$0	$0	$0	$0	$15.49	$0	$0	$0	$0.15	$0	$0	$0	$0	$0	$0	$15.64
Future regulatory requirements	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$41.03	$41.03
Future capacity expansion	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$19.06	$19.06
Repair and replacement funding	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.51	$2.85	$3.19	$3.53	$3.87	$24.45	$27.80	$68.20
Total	$1.40	$2.81	$7.91	$5.93	$41.85	$26.21	$25.84	$26.34	$3.25	$5.90	$5.76	$6.06	$6.40	$25.00	$88.49	$279.15

5.4 Project Funding and Financing

The capital improvements plans presented in Tables 7 and 8 will require investments by the City. The following sections describe the approach to funding these improvements, the full details of which will be further developed as part of future efforts.

5.4.1 Sewer Fund Budget

The City operates an enterprise fund (Sewer Fund) to fund all capital and operation and maintenance expenditures for the Nampa WWTP and collection system. The budgeted revenue for the Sewer Fund for FY18 is approximately $11.7 million. The capital improvements programs described in Tables 7 and 8 will be funded through the enterprise fund.

5.4.2 Funding Alternatives

The City is currently working on a cost of services study for the Sewer Fund. The outcome of this study will develop the cost of service for each customer class based on the flow and load contributions to the Nampa WWTP. Through this process, the City is investigating using both cash and bonding to finance the Preferred Alternative. The City will use the results of this study to set the new rates for the Sewer Fund.

5.4.3 User Charges

The City charges customers based on their usage of the City's wastewater system. Residential and commercial rates are charged based on water usage. Industrial rates are charged based on both flow and constituent loadings. The average residential bill is currently approximately $24.47. This rate will need to be increased to fund the Preferred Alternative. The amount of this increase will depend on the selected financing alternative.