# Centralized Sewage Treatment & Collection System, Spanish Town, St. Catherine, Jamaica

Feasibility Study and Master Plan

Prepared by
Derian Jackson & Adhem Mukattash

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# Presentation Plan

I. Background & Objectives
II. Existing Situation
III. Data Collection & Analysis
IV. Alternatives Analysis
V. Recommended Solution
VI. Implementation Plan
VII. Conclusion

# Presentation Plan

I. **Background & Objectives**
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# Background & Objectives

NWC completed Capital Investment Programme: outcomes include:

- Increased access to central sewerage services to 35% of the population in the medium-term

- Increase to 50% in the long-term
  - Provide central sewage services to the largest urban centre (Spanish Town)

- Cole Engineering Group Ltd. was engaged by NWC to prepare a feasibility study and master plan for the development of a central sewage collection & treatment System for Spanish Town
  - Six months contract

# Background & Objectives

Benefits:

- Improve sewage collection and treatment in these centers.
- Reduce pollution of surface & ground water
- Retire the large number of satellite sewerage facilities serving discrete housing developments
- Promote economies of scale by reducing incremental cost for this service provision.
- Facilitate development & economic growth

# Presentation Plan

I. Background & Objectives

**II. Existing Situation**

III. Project Scope

IV. Capital Cost

V. Expected Benefits

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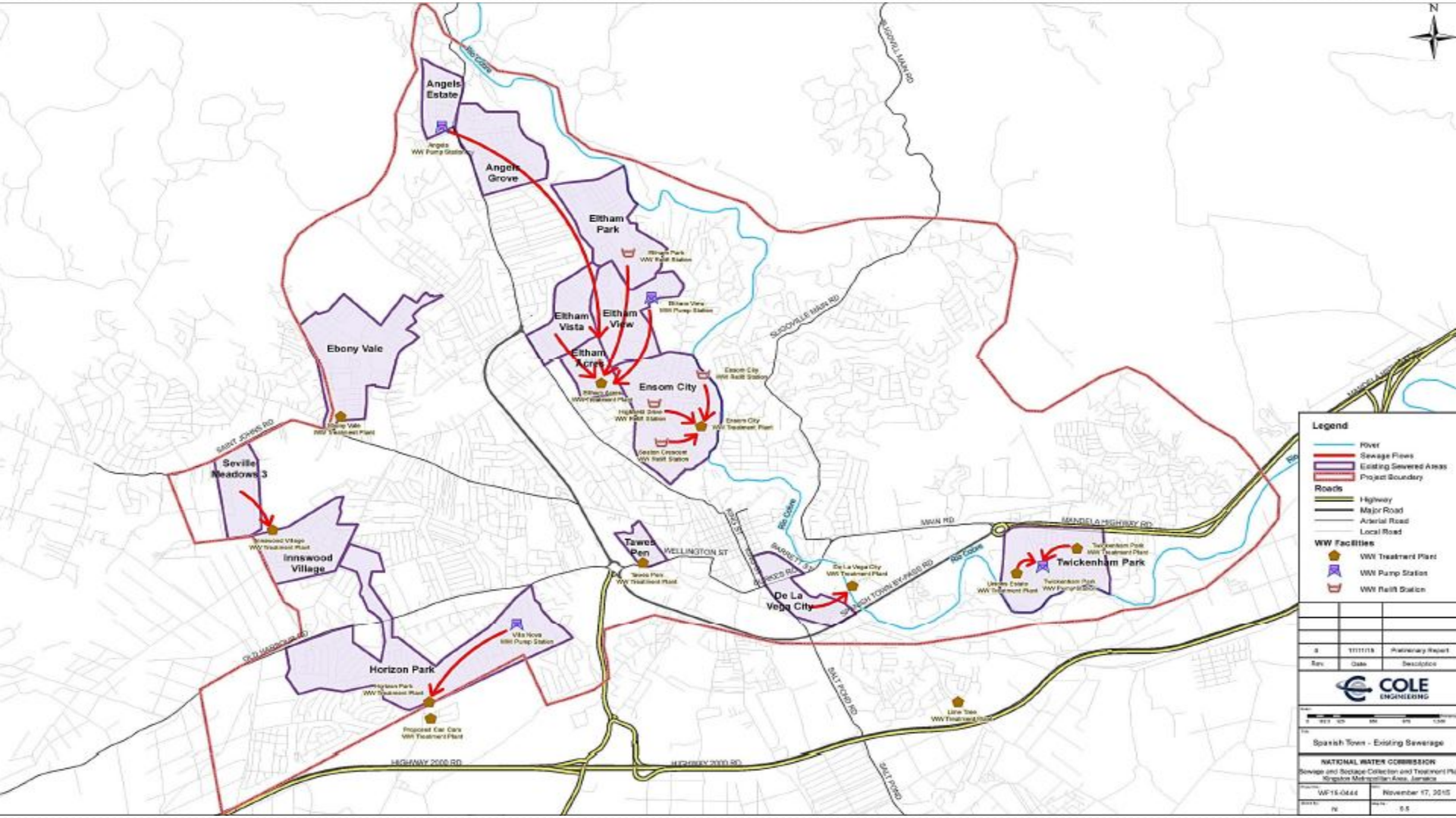
# Existing Situation

- Eight (8) small discrete treatment plants servicing small developments in Spanish Town which are operated by the NWC.
  - Plants not consistently meeting NEPA standards
  - In need of repair
- Two (2) other privately owned and operated treatment plants
  - White Water Meadows WWTP
  - Seville Meadows WWTP
- Nineteen per cent (19%) of Spanish has access to treatment system

# Existing Situation



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# Data Collection & Analysis

- Data was collected from the NWC and other agencies such as WRA, NEPA, NLA, Statin, etc. including but not limited to:
  - NWC Customer Billing
  - Census Information
  - Hydrogeological Basin Information
  - Reports on existing plants
  - Facility condition assessment was conducted on each WWTPs

- Information collected as well as the assessment carried out were used to estimate the design hydraulic and organic loads for the 50-year design horizon; under the following assumption:

# Data Collection & Analysis

- Assumptions:
  - The current calculated residential, commercial and industrial per capita consumption will remain unchanged over the design horizon;
  - The per capita consumption is constant for the parish of St. Catherine;
  - 90% of the water used will return to the sewers (return factor);
  - Infiltration/inflow rate for existing sewers is the same in the parish of Kingston and St. Catherine;
  - Only 90%of the population in the sewered areas are connected; and
  - The quality of the influent in the existing sewered areas will not change.

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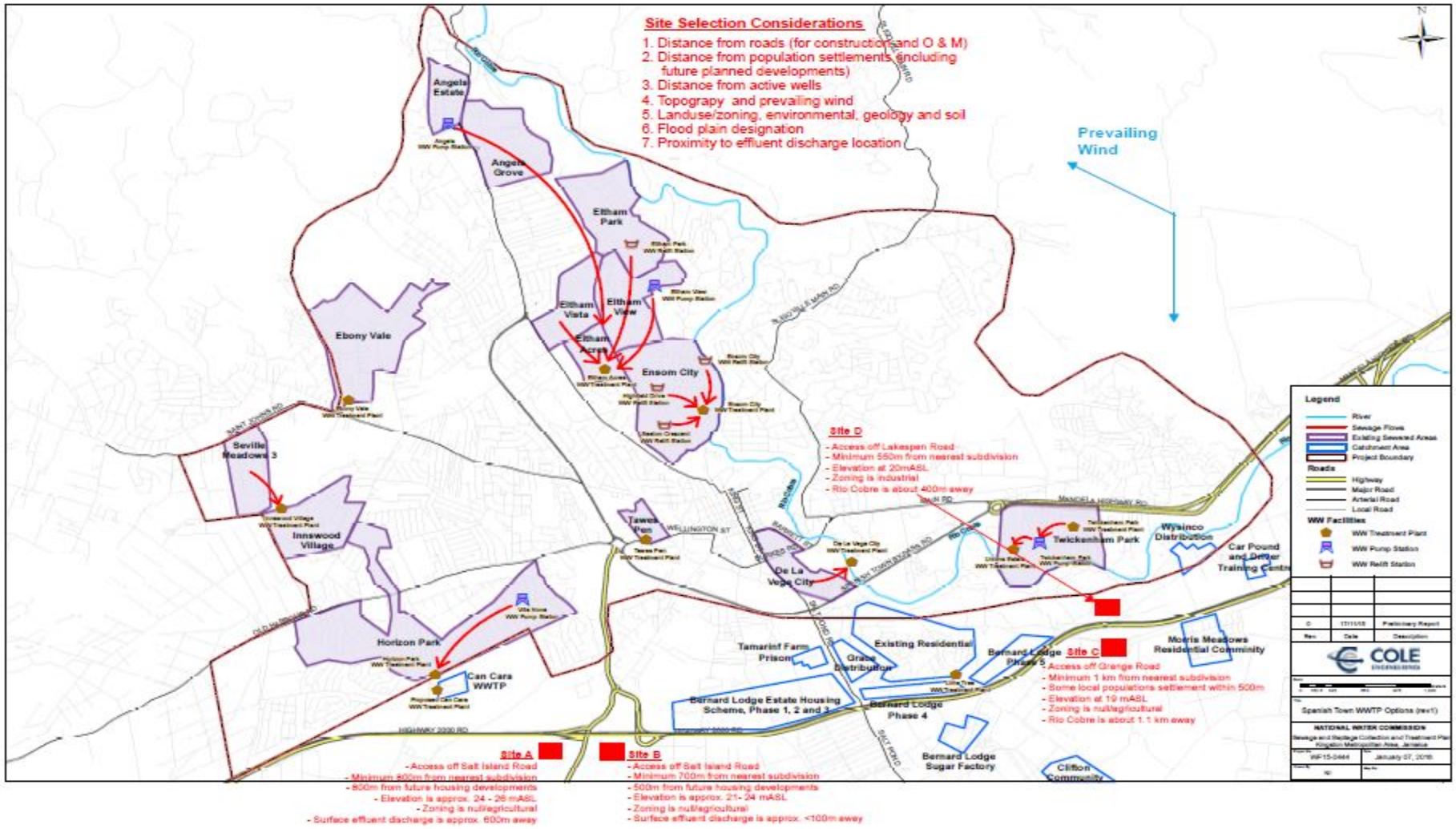
# Alternatives Analysis

- Initial screening process carried out to eliminate all unsuitable alternatives, including "do nothing", to arrive at the 3 most feasible alternatives. These are:
  - Central Sewage Collection Network
    - Option 1 – Develop a central network that flows to the south-western boundary of Spanish Town and retire existing WWTPs
    - Option 2 - Develop a central network that flows to the north-western boundary of the Spanish Town and retire existing WWTPs
    - Options 3 – Develop new WWTP for the rest of Spanish Town & upgrade some of the existing WWTPs
  - Central Sewage Treatment Facility
    - Option A - Extended aeration activated sludge,
    - Option B - Sequencing batch reactor, and
    - Option C - Facultative Lagoons/wastewater stabilization ponds.

# Alternatives Analysis



# Alternatives Analysis

- Detailed analysis was carried out on the 3 alternatives for both components, inclusive of quantitative and qualitative analysis
  - Four criteria were used, namely: technology, environmental impact, social/cultural impact, and financial impact.
    - Weightings ranging between 10 & 20 were assigned for each criteria
    - Rankings ranging between 0 & 4 were assigned for criteria

**Rakings**

| | | |
|---|---|---|
| Zero (0) | - | Does not fulfil criteria/sub-criteria |
| One (1) | - | Partially satisfies criteria/sub-criteria |
| Two (2) | - | Fairly satisfies criteria/sub-criteria |
| Three (3) | - | Substantially satisfies criteria/sub-criteria |
| Four (4) | - | Completely satisfies criteria/sub-criteria |

# Alternatives Analysis

| Criteria | Criteria Notes | Criteria Weighting (10 - 20) | West Option | East Option | Hybrid Sub Option |
|---|---|---|---|---|---|
| **Technical** | | | | | |
| Constructability | | 10 | 1 | 5 | 5 |
| Performance and capability consideration | ability for future expansion/modular | 15 | 0 | 0 | 0 |
| Proven technology | | 20 | 0 | 0 | 0 |
| Operation and Maintenance | Energy efficiency, maintainability | 20 | 5 | 5 | 4 |
| Accessibility/ suitability | | 18 | 4 | 4 | 4 |
| Safety | Occupational health and safety | 20 | 2 | 4 | 3 |
| **Natural environmental** | | | | | |
| Impacts on sensitive terrestrial habitats/species (flora and fauna) | | 10 | 3 | 3 | 3 |
| Impacts on sensitive aquatic habitats/species | | 15 | 4 | 2 | 1 |
| Impacts on groundwater/surfacewater systems | | 20 | 4 | 2 | 1 |
| **Social/Cultural/Legal:** | | | | | |
| Local acceptability | | 12 | 5 | 4 | 3 |
| Security and safety | Staff safety | 18 | 1 | 1 | 1 |
| Regulatory compliance | | 20 | 5 | 5 | 3 |
| Consistent with applicable parish provincial and local plans | | 10 | 4 | 4 | 3 |
| Short-term (construction) impacts on surrounding land users (odours, noise, traffic) | | 12 | 3 | 4 | 2 |
| Long-term (operation) impacts on surrounding land users (odours, noise, traffic) | | 15 | 4 | 3 | 2 |
| Archaeological impact | | 11 | 1 | 1 | 1 |
| Property acquisition requirement | Easement | 10 | 3 | 3 | 3 |
| **Financial** | | | | | |
| Capital Costs | For collection system not the treatment system | 15 | 3 | 3 | 2 |
| Power Cost | Electricity/ fuel | 18 | 3 | 4 | 3 |
| Life Cycle Cost | | 18 | 4 | 4 | 3 |
| Operation and Maintainance costs | | 18 | 4 | 4 | 3 |
| **Total Score** | | | **990** | **1003** | **758** |
| **Rank** | | | **2** | **1** | **3** |

# Alternatives Analysis

| Criteria | Criteria Notes | Criteria Weighting (10 - 20) | Extended Aeration | Wastewater Stabilisation Ponds | SBR |
|---|---|---|---|---|---|
| **Technical** | | | | | |
| Constructability | | 10 | 4 | 5 | 4 |
| Performance and capability consideration | ability for future expansion/modul | 15 | 5 | 3 | 5 |
| Proven technology | | 20 | 5 | 3 | 1 |
| Operation and Maintenance | Energy efficiency, maintenability | 20 | 3 | 5 | 2 |
| Safety | OHS | 20 | 3 | 4 | 3 |
| All Parameters achieved withour tertiary treatment | | 20 | 5 | 1 | 5 |
| **Narural environmental** | | | | | |
| Impacts on sensitive terrestrial habitats/species (flora and fauna) | | 10 | 3 | 2 | 4 |
| Impacts on sensitive aquatic habitats/species | | 15 | 3 | 5 | 3 |
| Impacts on groundwater/surfacewater systems | | 20 | 4 | 3 | 3 |
| **Social/Cultural/Legal:** | | | | | |
| Local acceptability | | 12 | 3 | 2 | 3 |
| Regulatory compliance | | 20 | 5 | 3 | 2 |
| Security and safety | | 18 | 4 | 3 | 4 |
| Consistent with applicable parish provincial and local plans | | 0 | 0 | 0 | 0 |
| Short-term (construction) impacts on surrounding land users (odours, noise, traffic) | | 12 | 2 | 2 | 2 |
| Long-term (operation) impacts on surrounding land users (odours, noise, traffic) | | 15 | 3 | 2 | 3 |
| Archaeological impact | | 0 | | | |
| Property acquisition requirement | | 20 | 4 | 2 | 5 |
| **Financial** | | | | | |
| Capital Costs | | 15 | 3 | 4 | 2 |
| Power Cost | Electricity/ fuel | 18 | 3 | 5 | 3 |
| Life Cycle Cost | | 18 | 3 | 5 | 2 |
| Operation and Maintainance costs | | 18 | 3 | 5 | 2 |
| **Total Score** | | | **1154** | **1072** | **953** |
| **Rank** | | | **1** | **2** | **3** |

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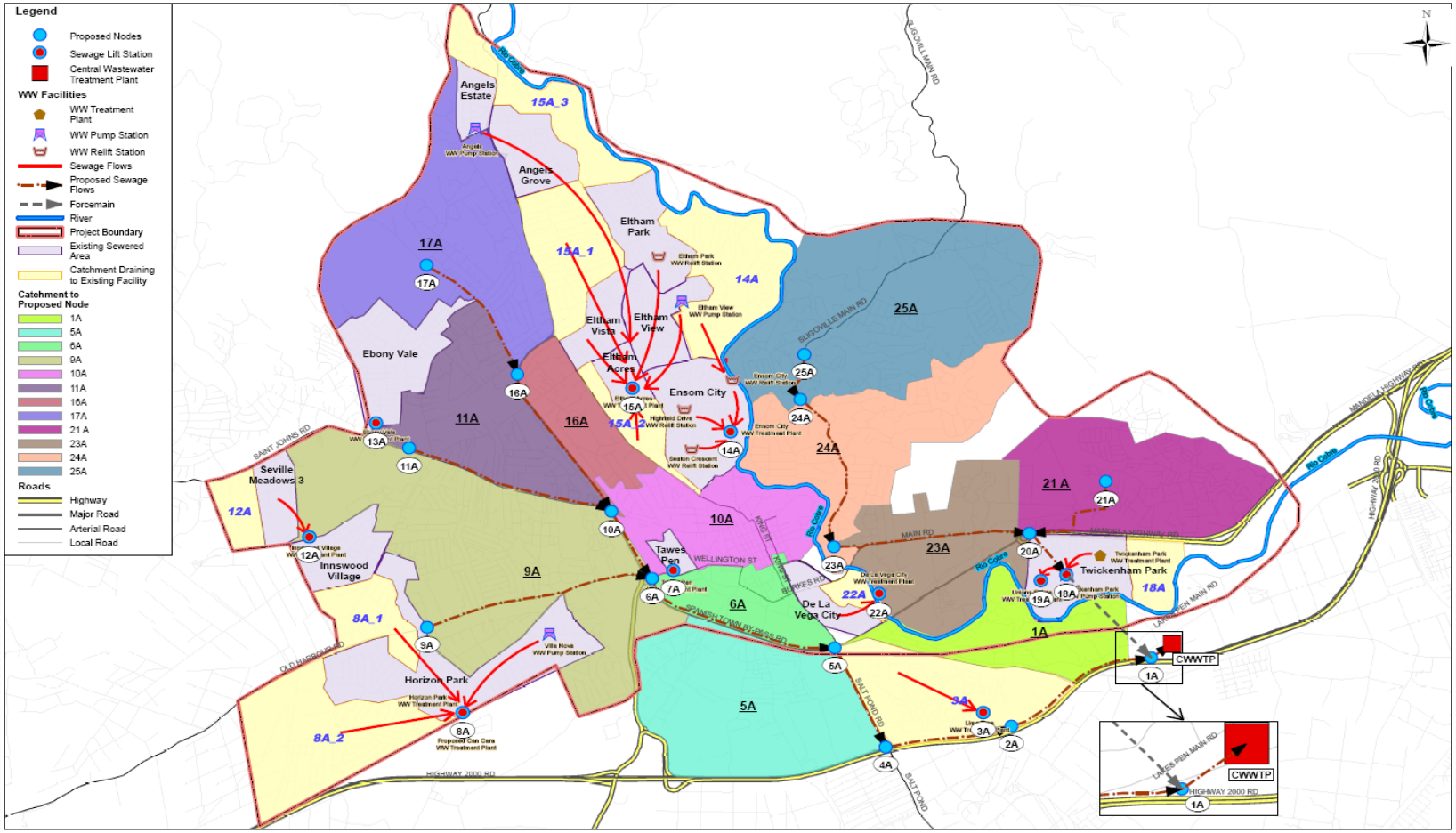
# Recommended Solution

- The recommended approach for the collection and treatment sewage system in Spanish Town includes:
  - Central treatment facility
  - Two trunk sewers (East & West)
  - Collection Network

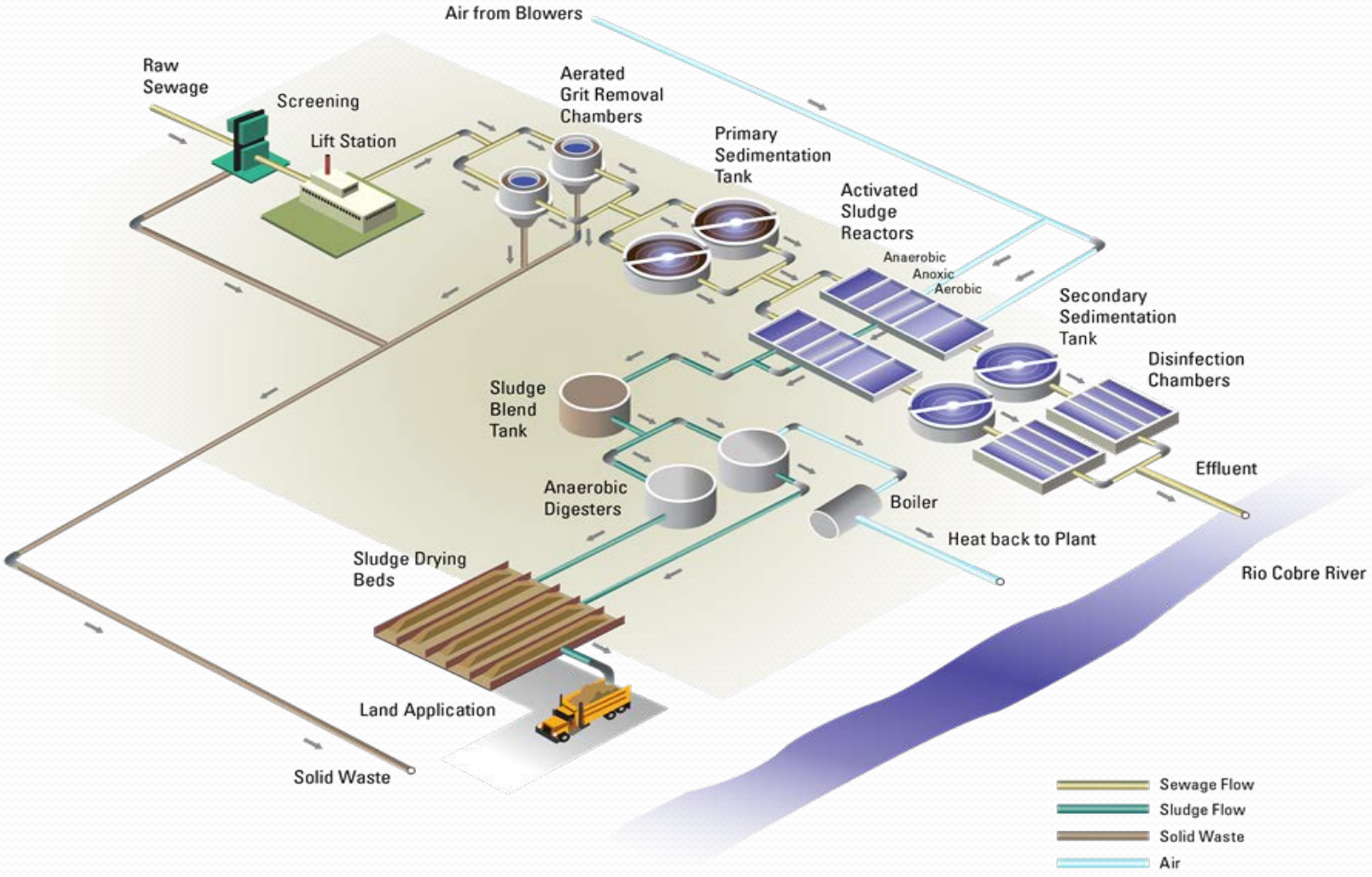
# Recommended Solution

## Central Sewer Collection Network



# Recommended Solution

## Central Sewage Treatment Facility – Extended Aeration Activated Sludge



# Alternatives Analysis

| Parameter | NEPA Design specifications | CWWTP Design Specifications | NEPA Effluent Standard | CWWTP Expected Effluent | Unit |
|---|---|---|---|---|---|
| TSS | 220 | 400 | 30 | 20 | mg/L |
| $BOD_5$ | 250 | 350 | 20 | <15 | mg/L |
| COD | 500 | 800 | 100 | <100 | mg/L |
| TN | 40 | 40 | 10 | <10 | mg/L |
| TP | 8 | 16 | 4 | <4 | mg/L |
| pH | 6 -9 | 6-9 | 6 -9 | 6-9 | |
| Temperature | 28 | 28 | | | $^{O}C$ |

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# Implementation Plan

- The proposal is for the project to be implemented in 4 phases throughout the project lifecycle (2021 – 2071).
  - Phase 1 – Completion of detailed design, construction of WWTP, construction of trunk and retirement of existing WWTPs
  - Phase 2 - Expansion of the WWTP in the year 2031 to accommodate the projected population up to the year 2046
  - Phase 3 - Expansion will begin in the year 2046 to accommodate the projected population up to the year 2061
  - Phase 4 - Expansion will begin in the year 2060 to accommodate the projected population up to the year 2071


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# Implementation Plan

| | Phase 1 | Phase 2 Expansion | Phase 3 Expansion | Phase 4 Expansion |
|---|---|---|---|---|
| Construction Year | 2019 | 2031 | 2046 | 2060 |
| WWTP Commissioning Year | 2021 | 2032 | 2047 | 2061 |
| Design Year | 2031 | 2046 | 2061 | 2071 |
| Design Year Population | 208,711 | 77,913 | 106,999 | 92,701 |
| Cumulative Population served | 208,711 | 286,624 | 393,623 | 486,324 |
| **Calculated WWTP Flows ($m^3/d$)** | **35,063** | **13,089** | **17,976** | **15,574** |
| **Actual WWTP Design Flow ($m^3/d$)** | **35,000** | **14,000** | **18,000** | **16,000** |
| **Cumulative Actual WWTP Design Flow ($m^3/d$)** | **35,000** | **49,000** | **67,000** | **83,000** |



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# Conclusion

- The Master Plan prepared by Cole will serve as the roadmap for the construction of the central sewage system in Spanish Town.
- The sanitary treatment system will be in service to year 2071
- The project is estimated to cost approximately US $526 M


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# Thank you for your attention