MURTAUGH CASE STUDY

RI BASINS AS SOLUTIONS FOR SMALL TOWNS

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Boise, Idaho
May 24-25

Making Our Clients Successful

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Presentation Outline

1. Background
2. Planning and Modeling
3. WWTP Improvements
4. WWTP Performance
5. Lessons Learned
6. Questions

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Murtaugh, Idaho

- Rural Community in South Central Idaho
- Located on Canyon Rim Above Snake River

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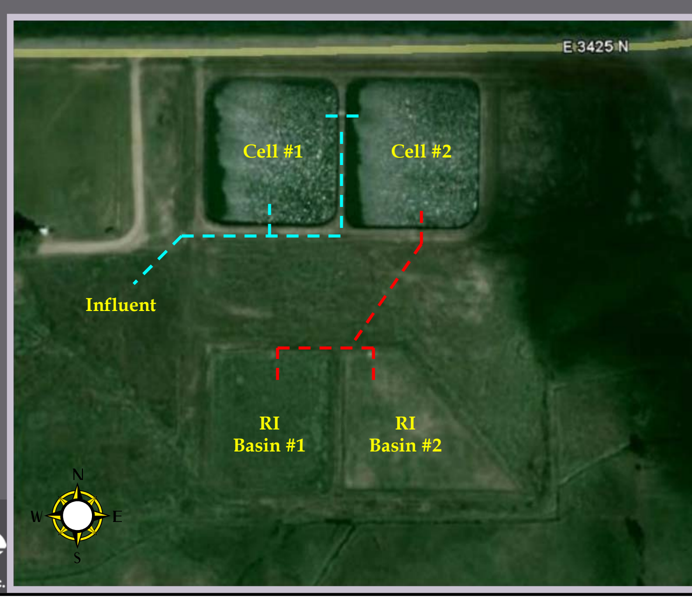
1. Background

Existing WWTP



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ackground

Flows and Loads

Parameter	2008	2028
Service Population	235	350
Flow (gpd)		
Average Day	27,900	41,700
Max Month	36,100	53,800
Peak Day	56,00	83,400
BOD (ppd)		
Average Day	69	102
Max Month	120	177
Peak Day	165	244

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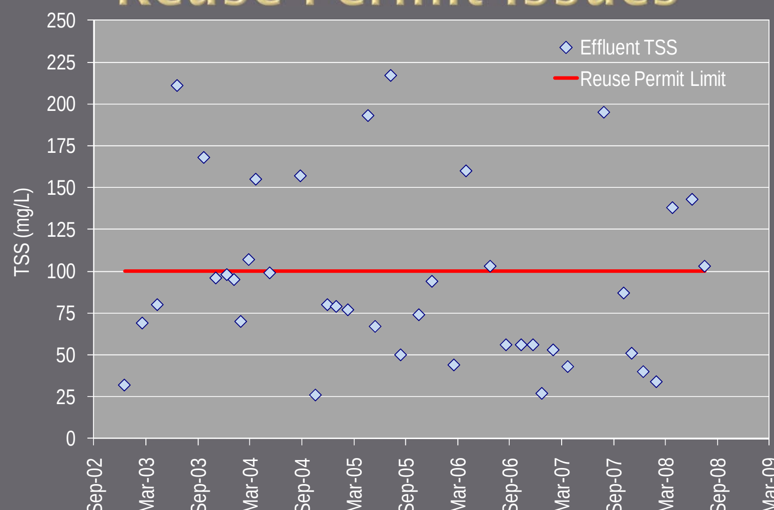
1. Background

Reuse Permit Issues



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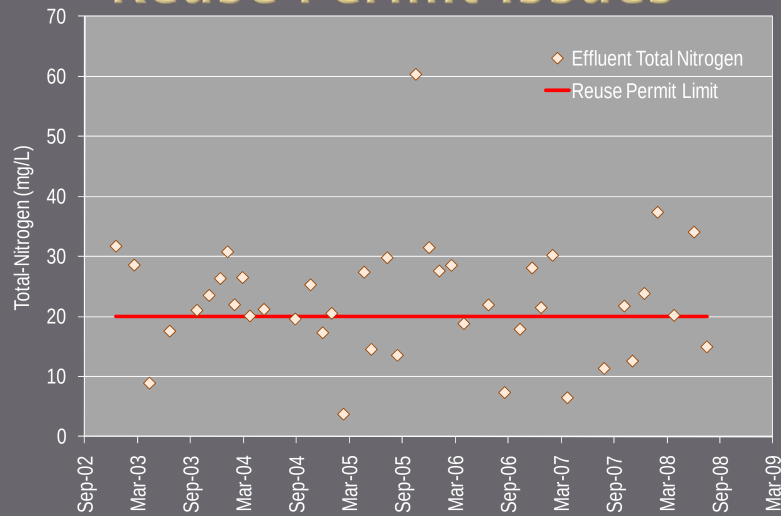
1. Background

Reuse Permit Issues



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1. Background

IDEQ Consent Order

November 2006	City Entered into Consent Order with IDEQ
October 2007	Complete Facilities Plan
December 2008	Complete Plans and Specs
April 2009	Begin Construction
April 2010	Commissioning

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1. Background

Initial Facilities Planning

- IDEQ → Continued Use of Lagoons and RI Basins Not a Likely Option
- Surface Water Discharge Not Feasible
  - Limited Waste Load Allocation Available
- Initial Improvement Alternatives
  1. Upgrade Existing Lagoons, Winter Storage, and Slow-Rate Land Application
  2. Mechanical Plant with RI Basins
  3. Regional Treatment

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2. Planning and Modeling

Initial Cost Estimates

Alternative	Capital Cost ($Million)	Annual O&M Costs ($Million)	Monthly User Rate [A] ($/month)
Lagoons & Slow-Rate Land Application	$2.2 - $2.5	$0.053	**$103 - $166**
Mechanical WWTP	$2.5 - $3.1	$0.107 - $0.113	**$160 - $250**

A – Dependent on Amount of Grant and Loan Funds Provided for Project

All Costs in 2008 Dollars.

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2. Planning and Modeling

Variance to Water Quality Standards?

- Costs for Traditional Solutions Not Feasible
- City and IDEQ Agreed to Investigate a Potential Variance to the Reuse Standards for Nitrogen and TSS
  - Continue Using Existing Lagoons and RI Basins with Improvements to Optimize their Performance?

Identify Key Design Parameters
1. Nitrogen Impacts on Groundwater
2. Phosphorus Impacts on Surface Water
3. TSS Impacts on RI Basin Operation

→

Analyze System Performance
1. Nitrogen and Phosphorus Removal and Transport Modeling
2. TSS Management Strategies

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2. Planning and Modeling

Nitrogen Removal and Transport

- Nitrification/Denitrification in RI Basins
  - Soil Characteristics
  - Effluent Carbon/Nitrogen Ratio
  - RI Basin Management
  - Predicts Dosing/Resting Periods and C:N Ratio's
- Nitrogen Impacts on Groundwater
  - Modeled Using Mixing Zone Analysis

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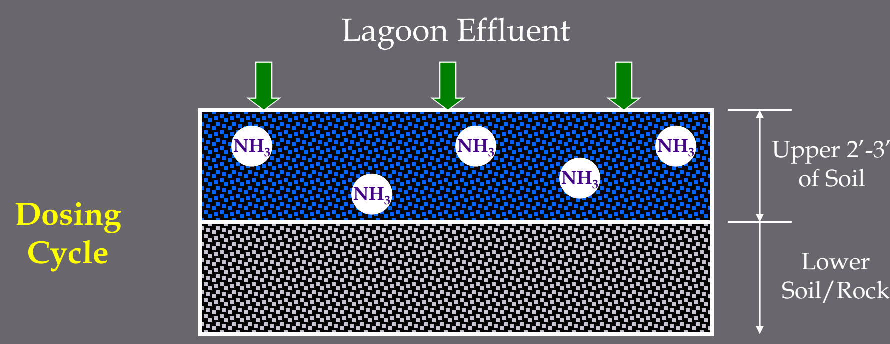
2. Planning and Modeling

Nitrogen Loading



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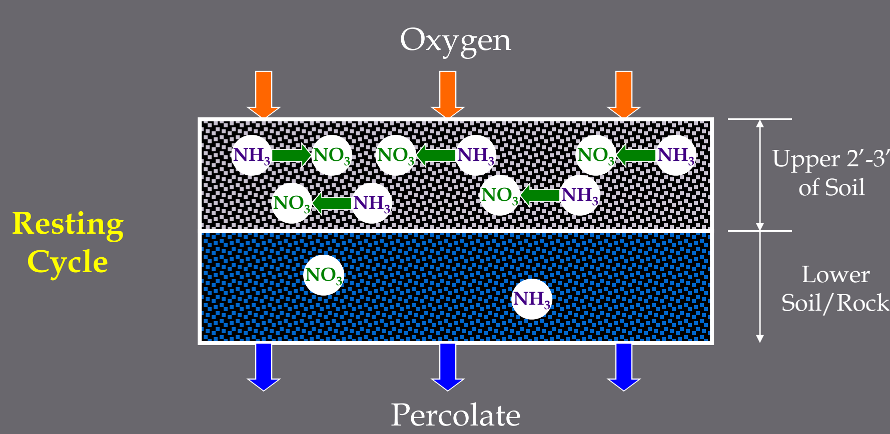
2. Planning and Modeling

Nitrification



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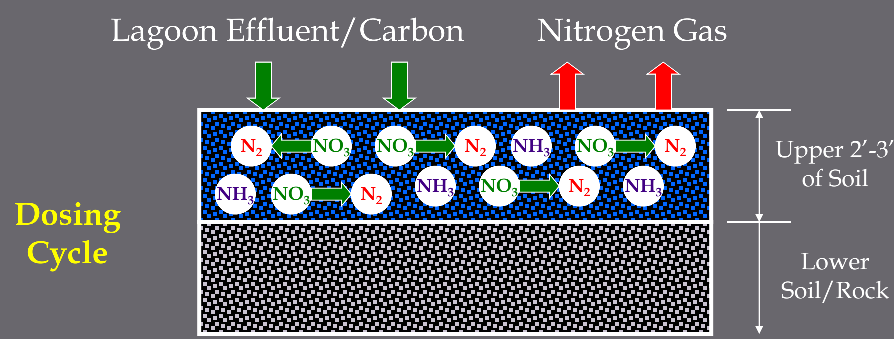
2. Planning and Modeling

Denitrification



2. Planning and Modeling

Nitrogen Modeling Results

Parameter	Model Output	Typical Value
Dosing Period	8 – 11 days	7 – 12 days
Resting Period	5 – 7 days	10 – 16 days
Min. BOD for Denitrification	11.2 mg/L	87 mg/L
Nitrogen Removal	60 – 80%	50 – 80%
Percolate Nitrogen	4.6 – 9.3 mg/L	-

2. Planning and Modeling

Nitrogen Impacts on Groundwater

Parameter	Units	60% N Removal	80% N Removal
Upgradient Groundwater Nitrogen	mg/L	2.3	2.3
Percolate Nitrogen	mg/L	9.3	4.6
Mixed Groundwater Nitrogen	mg/L	3.3	2.6
Increase in Downgradient Groundwater Nitrogen	mg/L	1.0	0.3
Acceptable to IDEQ?	mg/L	✓	✓

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2. Planning and Modeling

Phosphorus Removal and Transport

- Phosphorus Removal Mechanisms
  - Filtration, Adsorption, Precipitation, Etc.
  - Generally Termed "Sorption"
- 30 – 100% Phosphorus Removal (EPA)
- Langmuir Isotherm Analysis
  - Phosphorus Sorption Capacity
  - RI Basin #1 – 1,377 ug/g
  - RI Basin #2 – 1,054 ug/g

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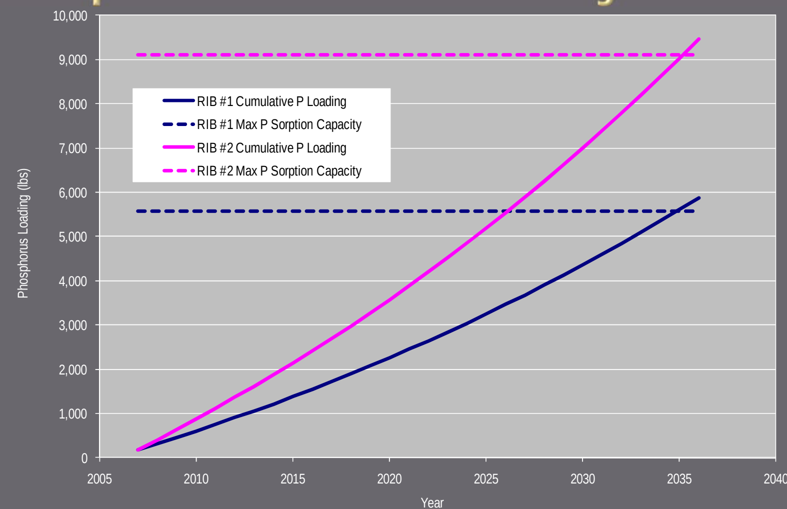
2. Planning and Modeling

Phosphorus Removal Projections



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2. Planning and Modeling

TSS Management

- Discharge Effluent At Night
- Avoid Discharging During Algal Blooms
- Provide Sufficient Drying Periods Between Discharge
- Maintain Plant Growth in RI Basins
- Scarify Surface of RI Basins as Needed)
- Install Mechanical Surface Aerators

Average Annual TSS Effluent Loading Rate (lbs/acre-d)	Typical Design Loading Rate A (lbs/acre-d)
25	40 - 158

A. Source: WEF Natural Systems for Wastewater Treatment, 2nd Edition

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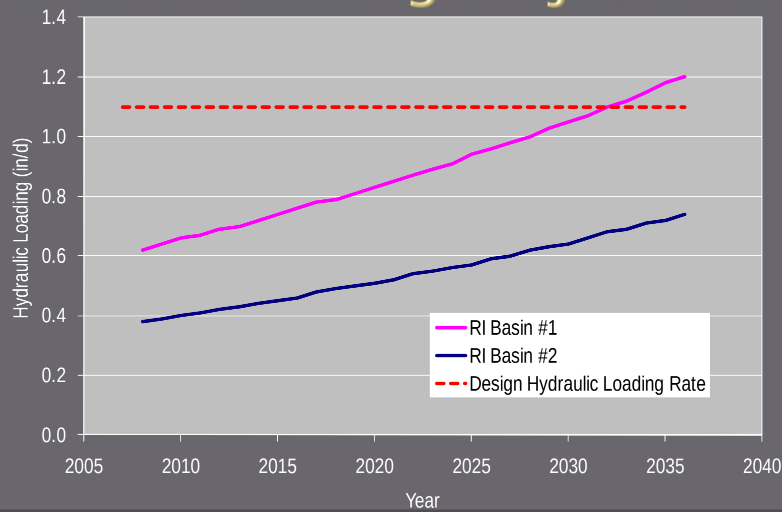
2. Planning and Modeling

Hydraulic Loading Projections



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2. Planning and Modeling

Nitrogen and TSS Variance

- IDEQ Granted a Variance to the Reuse Rules in March 2009
- New Reuse Permit Limits (30-Day Averages)
  - Total Nitrogen – 30 mg/L
  - TSS – 150 mg/L
- Revise O&M Manual for TSS Management
- Reuse Activities Cannot Cause a Violation of Idaho Groundwater Quality Rule

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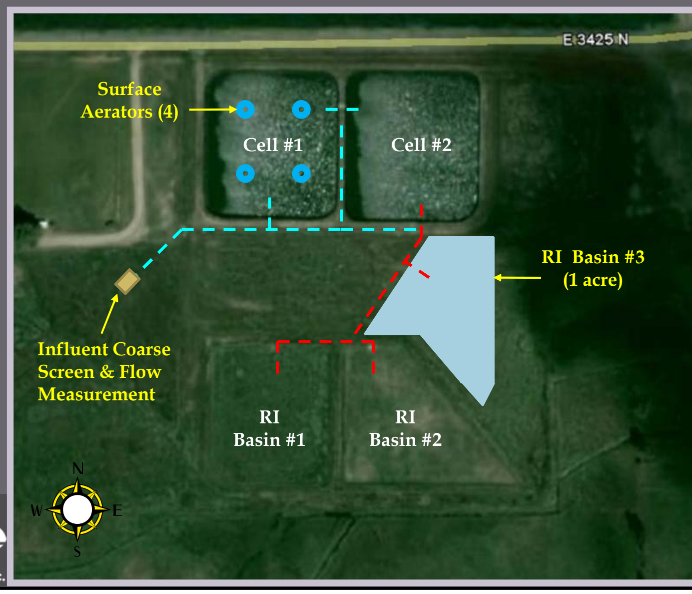
3. WWTP Improvements

Constructed Improvements



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Revised Costs

Alternative	Capital Cost ($Million)	Annual O&M Costs ($Million)	Monthly User Rate [A] ($/month)
Lagoons & Slow-Rate Land Application [B]	$2.2 - $2.5	$0.053	$103 - $166
Mechanical WWTP [B]	$2.5 - $3.1	$0.107 - $0.113	$160 - $250
Upgrade Lagoons & New RI Basin [C]	**$0.54**	**$0.039**	**$41 - $48**

A – Dependent on Amount of Grant and Loan Funds Provided for Project

B – Costs in 2008 Dollars.

C – Costs in 2010 Dollars.

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Construction

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3. WWTP Improvements

Construction

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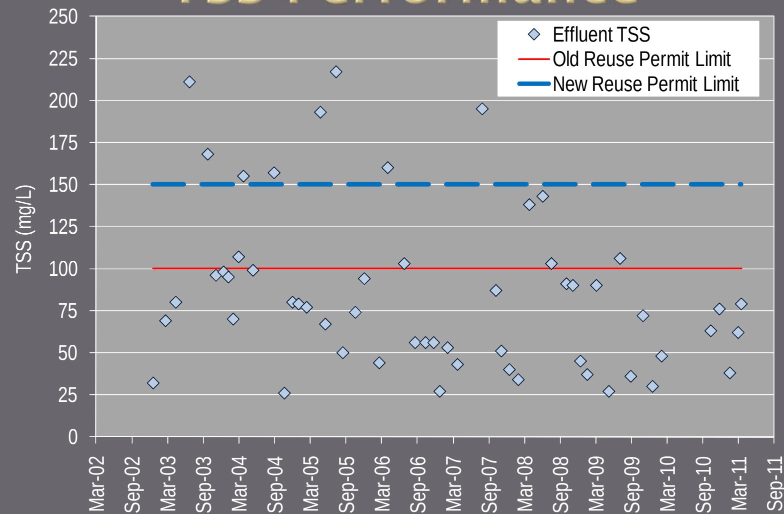
3. WWTP Improvements

TSS Performance



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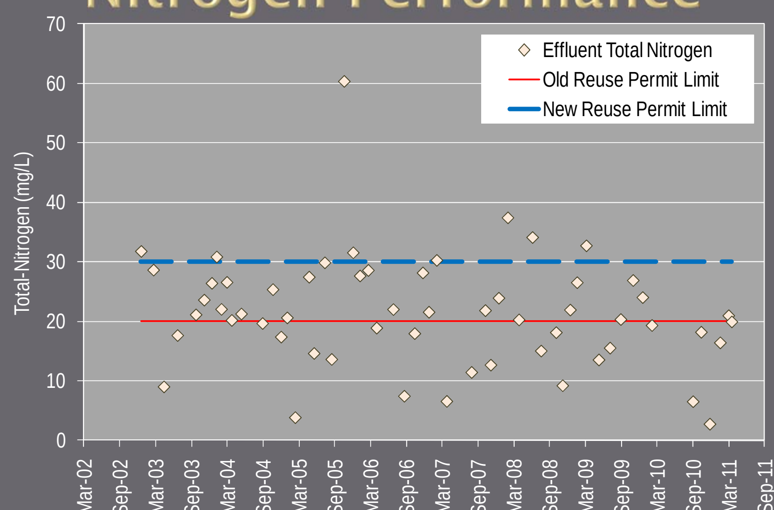
4. WWTP Performance

Nitrogen Performance



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4. WWTP Performance

Lessons Learned

- RI Basins are a Viable Option for Small Lagoon Systems
- Water Quality Variances May be an Alternative Solution
- Operation, Management, and Monitoring are Critical
- Work Closely with Regulatory Agencies

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5. Lessons Learned

Questions?

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6. Questions