City of Hastings
Well Based Nitrate and Uranium Management Plan

August 9, 2013

HASTINGS UTILITIES

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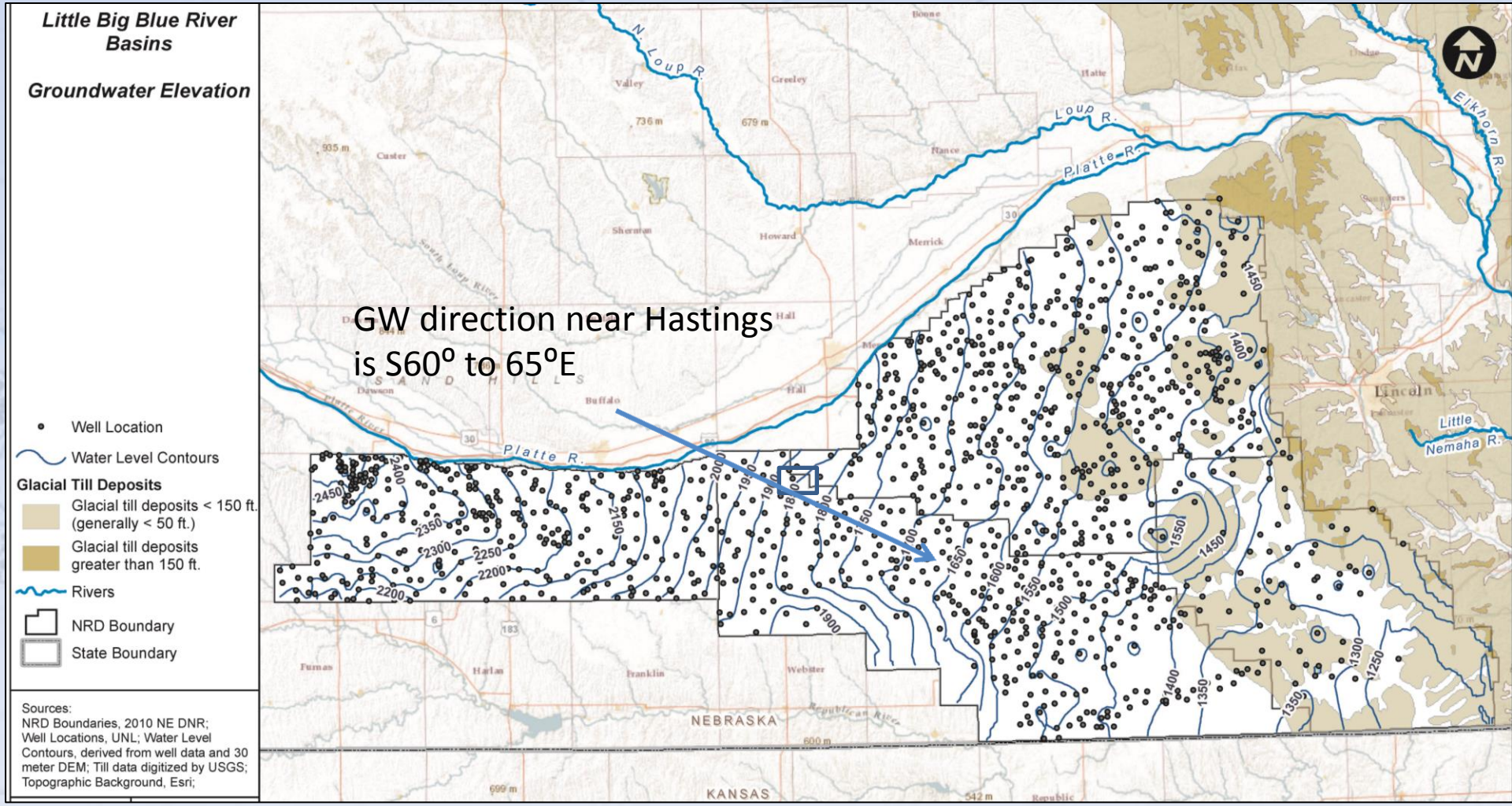
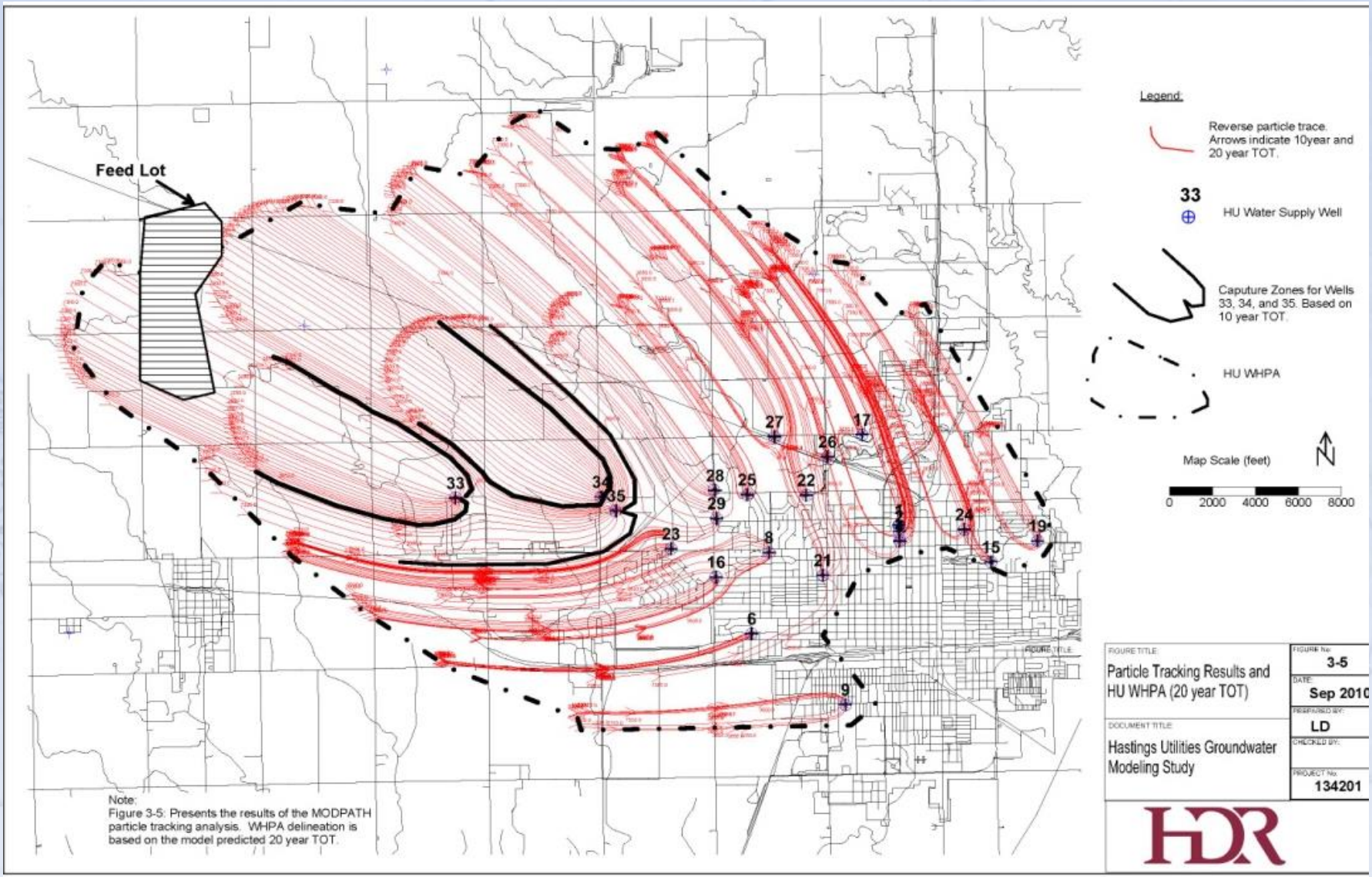
Hastings Water System - Overview

- Water Supply Wells pump water from multiple locations directly into the Water Distribution System without Treatment or Storage
- Water is supplied to the Village of Trumbull, Phil Johnson Water System and the Hastings East Industrial Park / Central Community College
- Neighboring Water Systems within 2 to 5 miles include the Villages of Juniata, Glenvil, Inland, AC Schools and several rural subdivisions

Regional Groundwater Flow



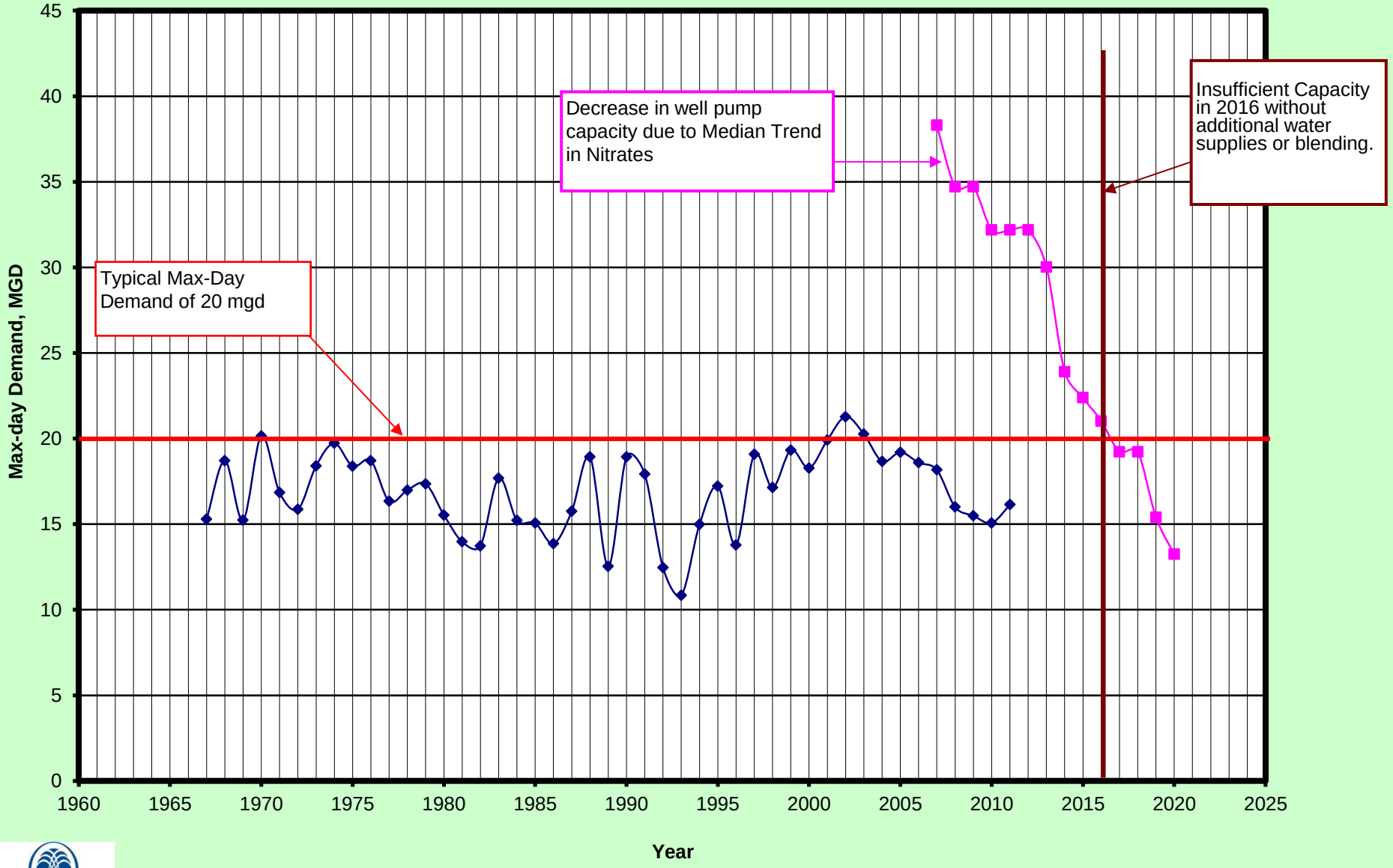
20 Year Time of Travel



Hastings Water Issues - Overview

- Nitrate, Uranium, Gross Alpha, Selenium, pH and Inorganic Levels Increasing
- Atrazine Detected at low levels
- Several Wells Taken Off Line due to Nitrates
- Insufficient Capacity in 2016 Without Additional Water Supplies or Blending

Median Nitrate Capacity Trend vs Max-Day Demand



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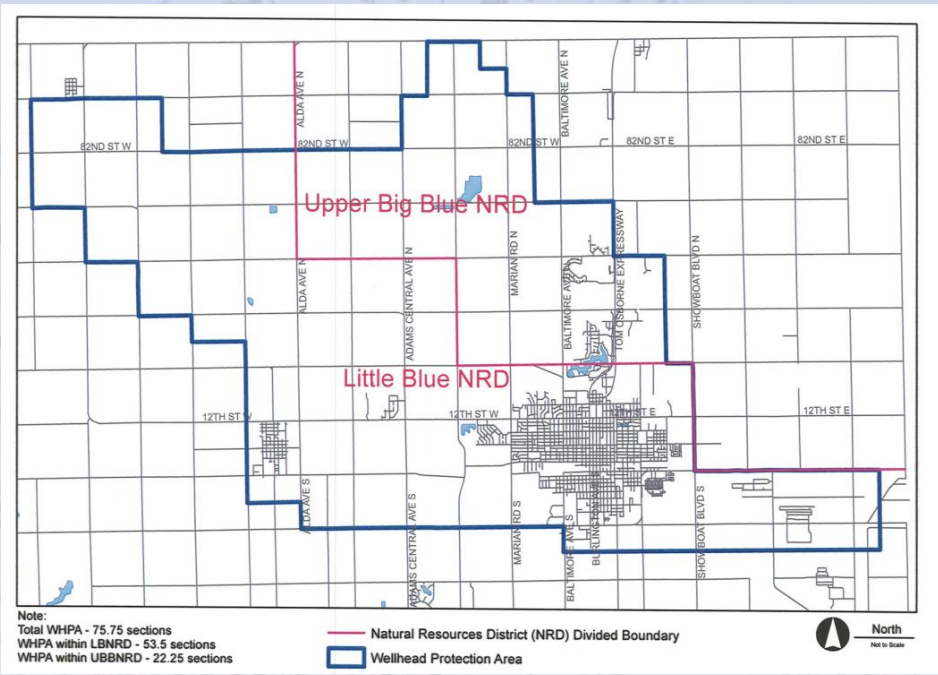
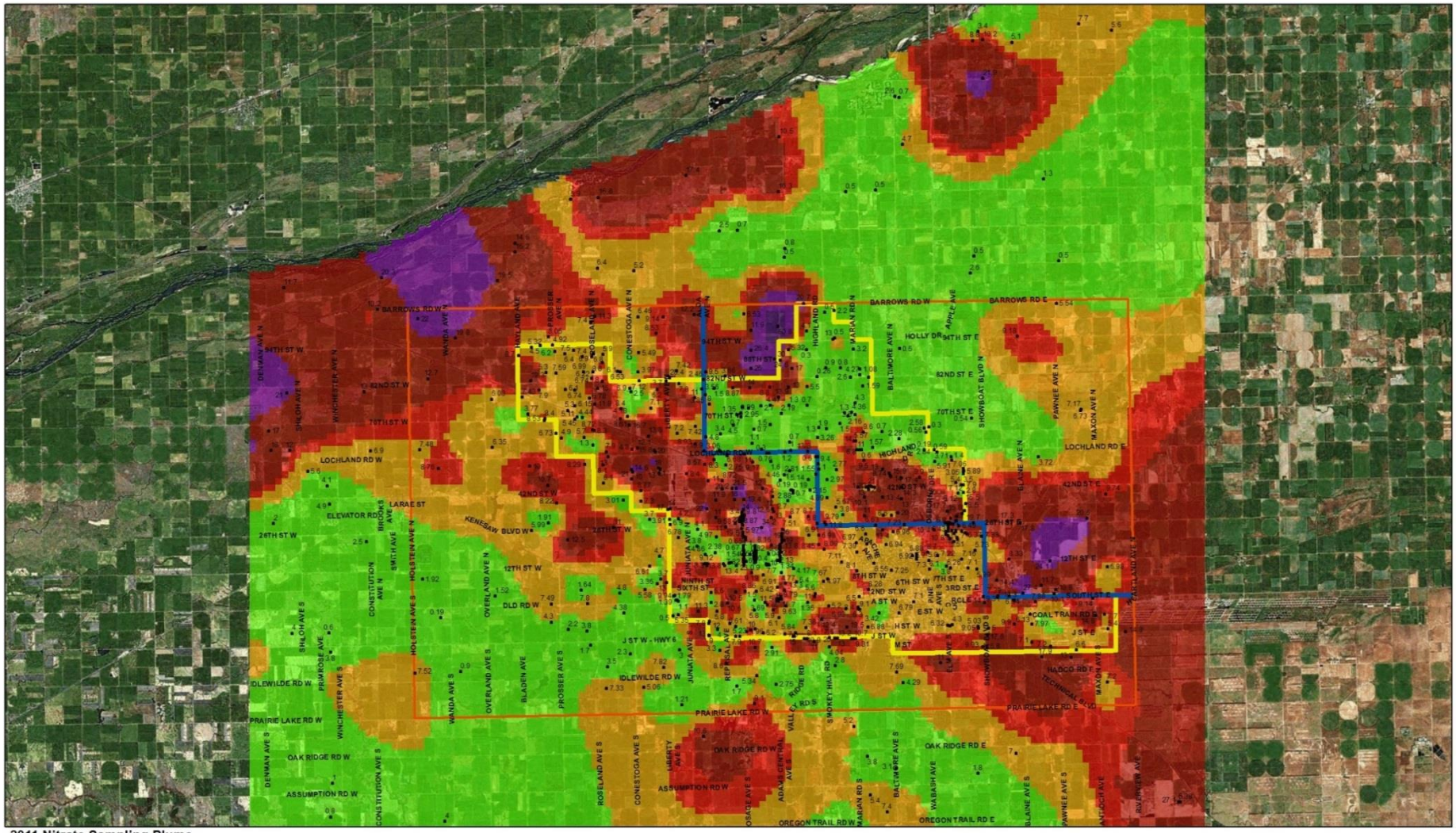
HU Board: “Marching Orders”

- Implement WHP to help address long term water quality issues and continue efforts to educate the public
- Enlist the assistance of the NRDs as they have jurisdiction outside the City of Hastings
- Find a cost effective method to secure a potable water source – “Think outside the box”



Nitrates in Well Head Protection Area



Hastings Wellhead Protection Area (HWPA) - Water Sampling Effort

- 2010 Sampling
  - 576 water samples collected for nitrates over 76 square mile area
  - 87.5% sampling of all known wells in the HWPA
- 2011 Sampling
  - 200 water samples collected in an area exceeding 200 square miles
  - 42 samples analyzed for uranium
- Results from 2010 and 2011
  - 25% of samples exceeded nitrate MCL (10 mg/L)
  - Uranium levels ranged from 1.2 to 74.8 µg/L (MCL 30 µg/L)

Hastings Wellhead Protection Area (HWPA) - Water Sampling Effort

- 2012 Sampling
  - 138 water samples collected
  - 25 % of samples exceeded nitrate MCL (10 mg/L)
  - Uranium levels ranged from 1 to 345 µg/L (MCL 30 µg/L)
- 2013 and Beyond
  - Continue sampling (50 to date)

Hastings Wellhead Protection Area (HWPA) - Water Sampling Effort

- 2010 Vadose Zone sampling indicates 500 to 2000 lbs. of Nitrogen is located below the Root Zone and above the Aquifer – Future Contamination Source

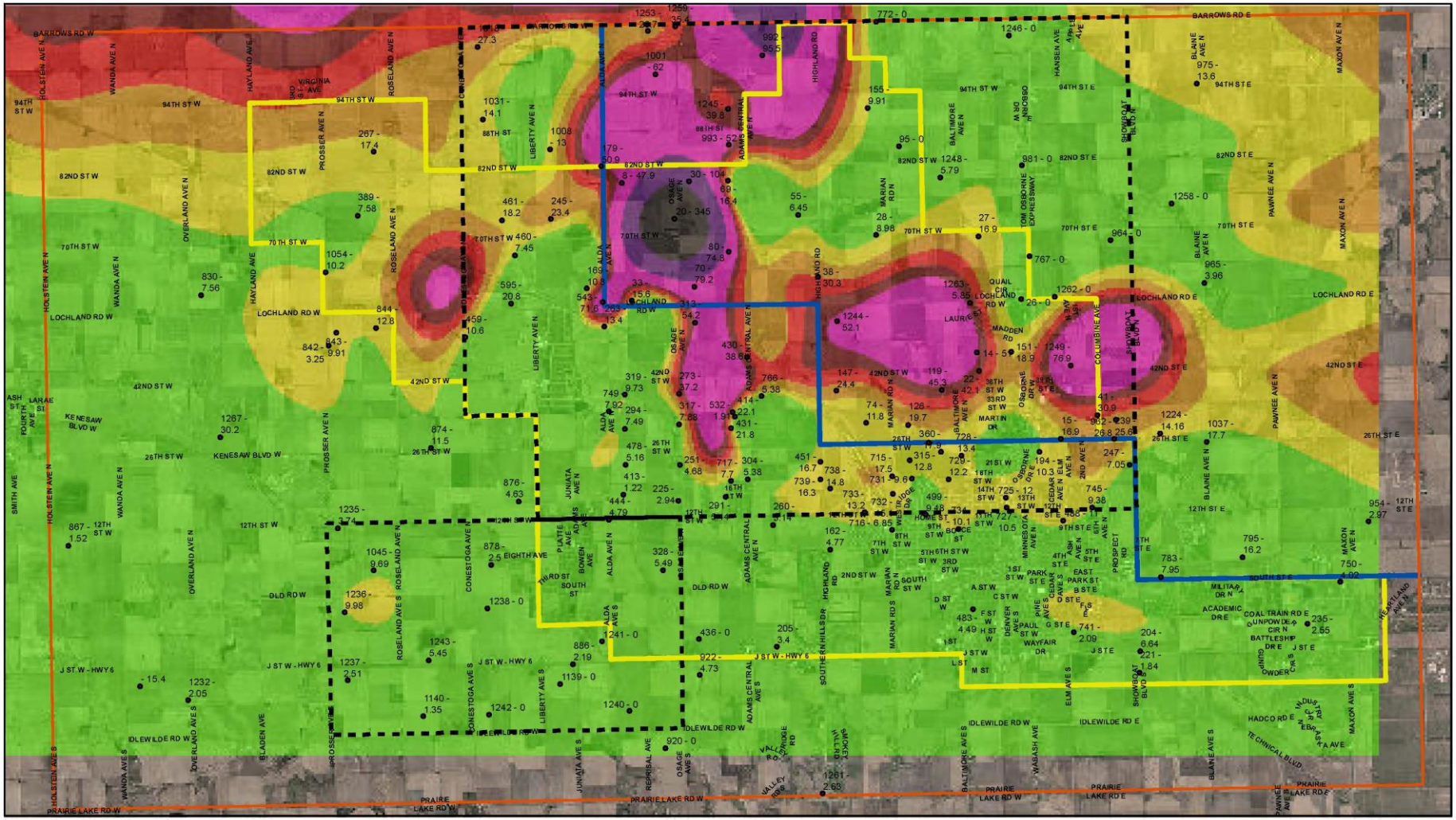
- Isotope sampling indicates the source of Nitrates is Commercial Fertilizer – Anhydrous Ammonia

Nitrates Source

- Nitrates are from both urban and rural use of fertilizer and excessive irrigation
- Nitrate and Water Management
  - Nitrate Management (Reduce wasting - 30%)
  - Water Conservation (Limit movement of N)

Best Management Practice must include both the proper use of Fertilizer and Irrigation. Overuse of Irrigation drives the Nitrogen below the root zone thus requiring more Fertilizer.

Uranium in Well Head Protection Area



Uranium the Unexpected Problem

- Uranium Source is Unknown
  - Naturally Occurring?
  - Phosphate Fertilizers?
  - Biological release of Uranium in the Vadose Zone?
- If naturally occurring why is it now showing up in the Municipal Wells?

How do we Solve the Problem?

- New Source?
  - No alternative aquifers are available
  - Nitrate sampling indicates contamination in principal aquifer cannot be avoided
- Conventional Water Treatment?
  - No existing treatment facility
  - No centralized collection point
- Wellhead Management?
  - Won't solve the problem alone (Long Term Issue)

Management Plan Objectives

- Continue to Provide Safe and Reliable water
  - Nitrates and Uranium are a 50 year problem (or more)
- Minimize Financial Impact to Utility and Customers
- Protect Long Term Viability of Aquifer
- Extend Useful Life of Existing Wells and Delay/Minimize Treatment

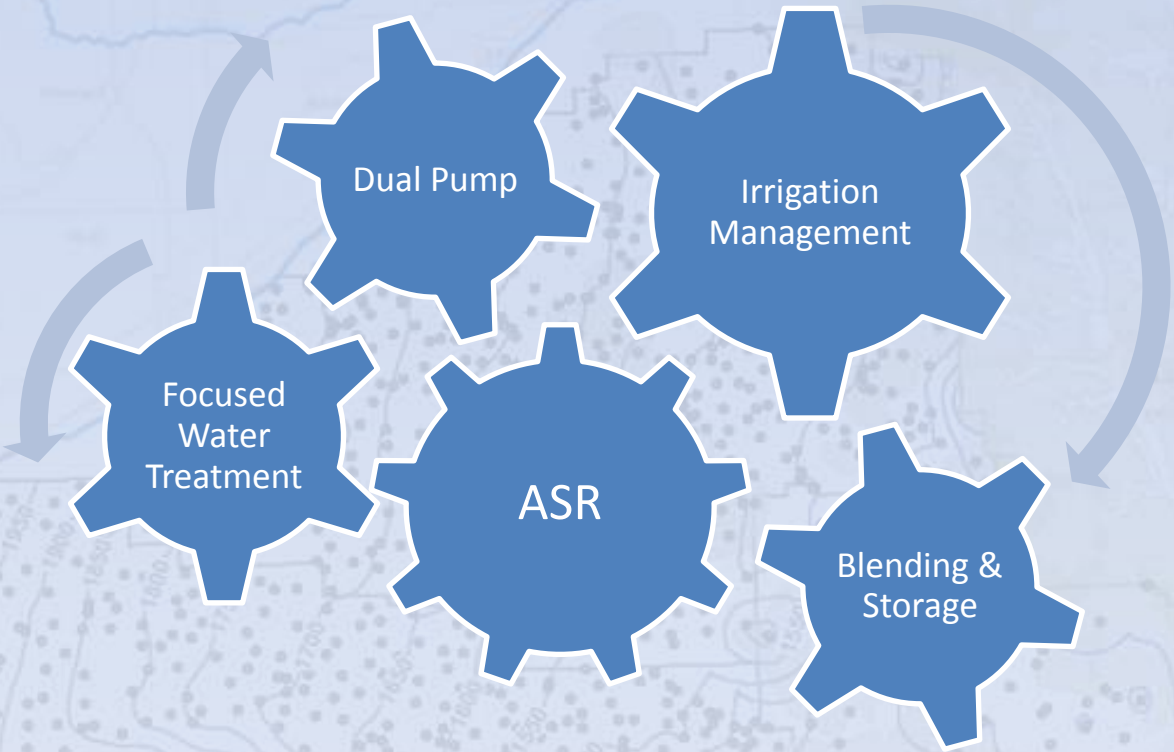
20-Year Facility Implementation Plan Phase 1 Water Treatment Costs (2010 Dollars)

Phase	Date	Project	Description	RO Only Treatment	IX Only Treatment	Annual O&M Costs [4]
1	2011	1a	Westbrook Water Treatment Plant Phase 1	$ 3,700,000	$ 3,700,000	$ 280,000
		1b	Westbrook Water Treatment Plant Phase 2	$ 1,700,000	$ 1,700,000	$ 280,000
2	2011-2014	2	Storage and Pump Station[2] at Future North Baltimore WTP Site	$ 14,300,000	$ 14,300,000	$ 230,000
		3	Chemical Treatment Building[3]			
		4	Piping Network Phase 1			
3	2013-2018	5	Piping Network Phase 2 and 3	$ 31,800,000	$ 23,800,000	$ 650,000
		6	North Baltimore Water Treatment Plant Phase 1			
			Treatment Facility[1]			
			Evaporation Pond (2 Cells)			
			Pipe to WPCC			
4	2019-2025	7	North Baltimore Water Treatment Plant Phase 2	$ 18,300,000	$ 10,600,000	$ 650,000
			Treatment Facility[1]			
			Evaporation Pond (2 Cells)			
			Pipe for Agricultural/Irrigation Blending			
5	2026-2030	8	Elevated Storage Tank at South Location	$2,500,000	$ 2,500,000	N/A
			Estimated Total:	**$ 72,300,000**	**$ 56,600,000**	

$100,000,000 could be spent over the next 20 years for Capital and Operating Expenses

Well Based Nitrate and Uranium Management Approach – Preliminary Design

- Dual Pumping
- Aquifer Storage and Restoration
- Focused Water Treatment
- Irrigation Management
- Blending and Storage

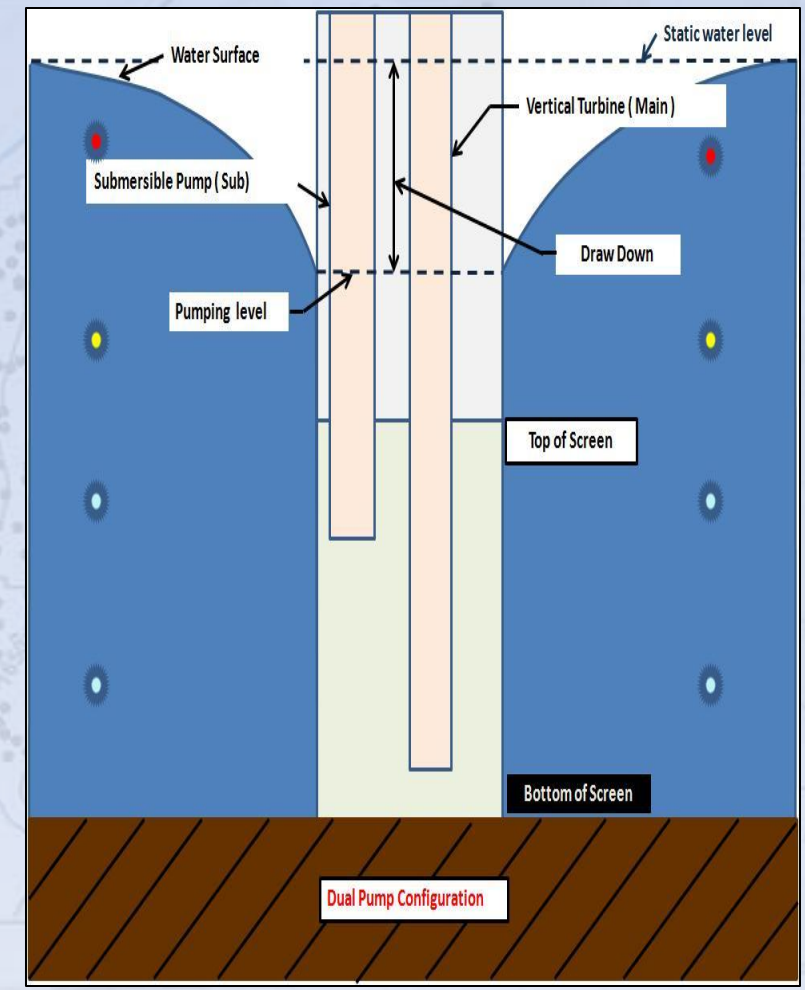


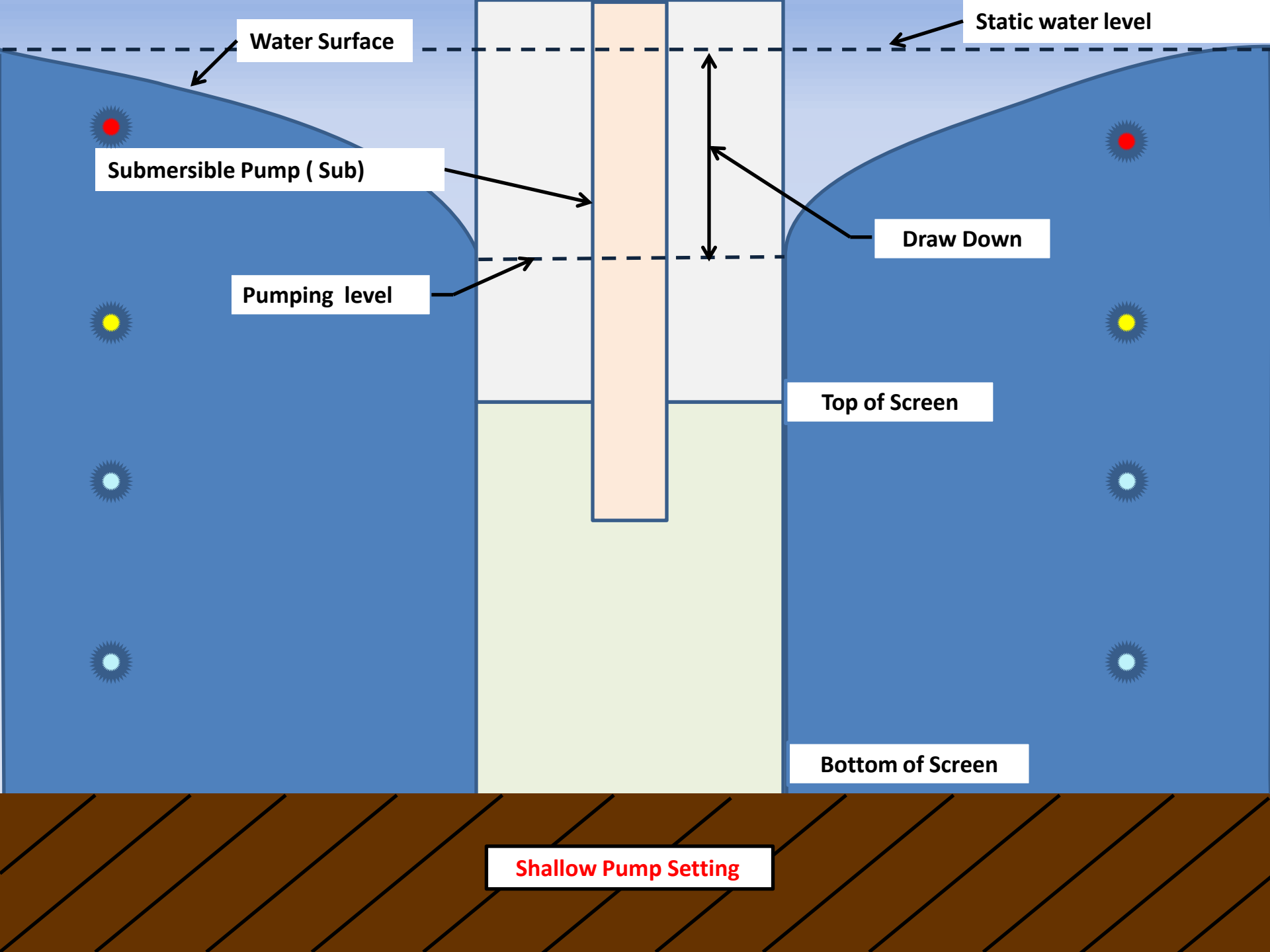
COMBINATION OF ALL APPROACHES

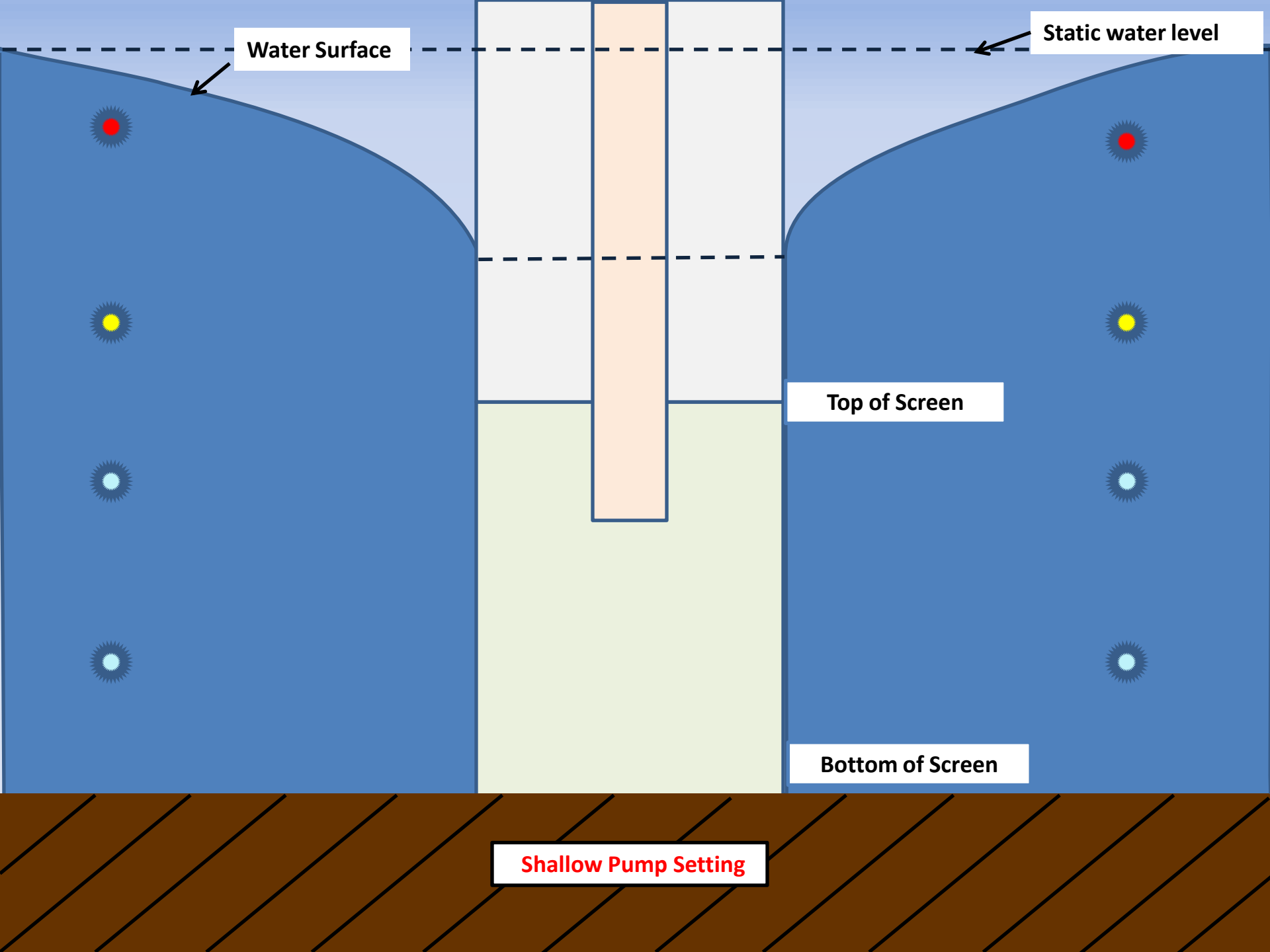
Potential to Substantially Reduce Capital Investments in Infrastructure and Operating Costs

Nitrate Skimming (Dual Pump)

- Goal – Extend useful life of existing Wells and delay/minimize treatment
- Nitrates appear to be highest at the top of the aquifer
- Dual Pumping is an idea where two wells located in close proximity simultaneously withdraw water from the top of and bottom of the aquifer thus separating these two water layers




Static water level
Water Surface
Submersible Pump (Sub)
Draw Down
Pumping level
Top of Screen
Bottom of Screen
Shallow Pump Setting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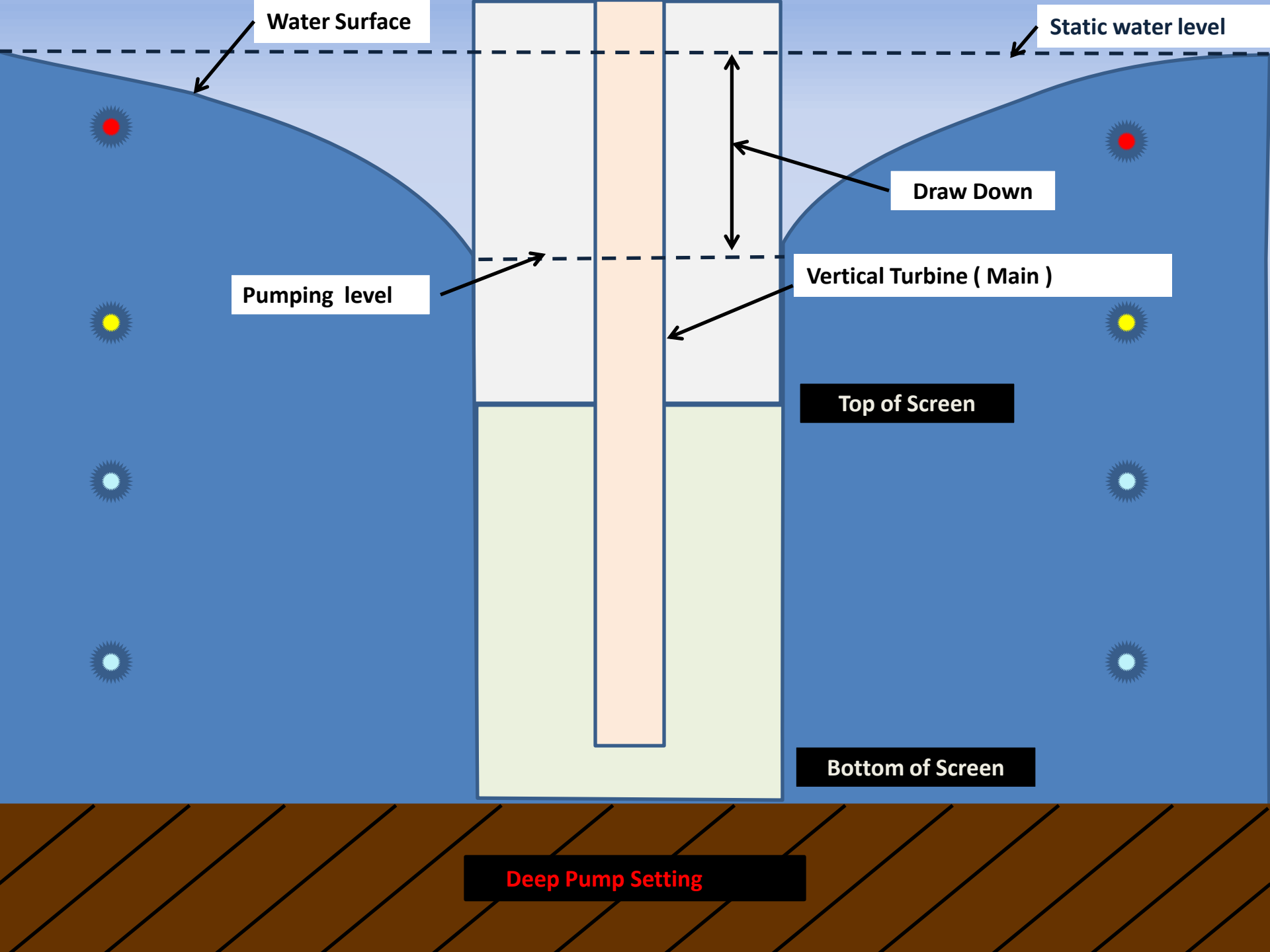
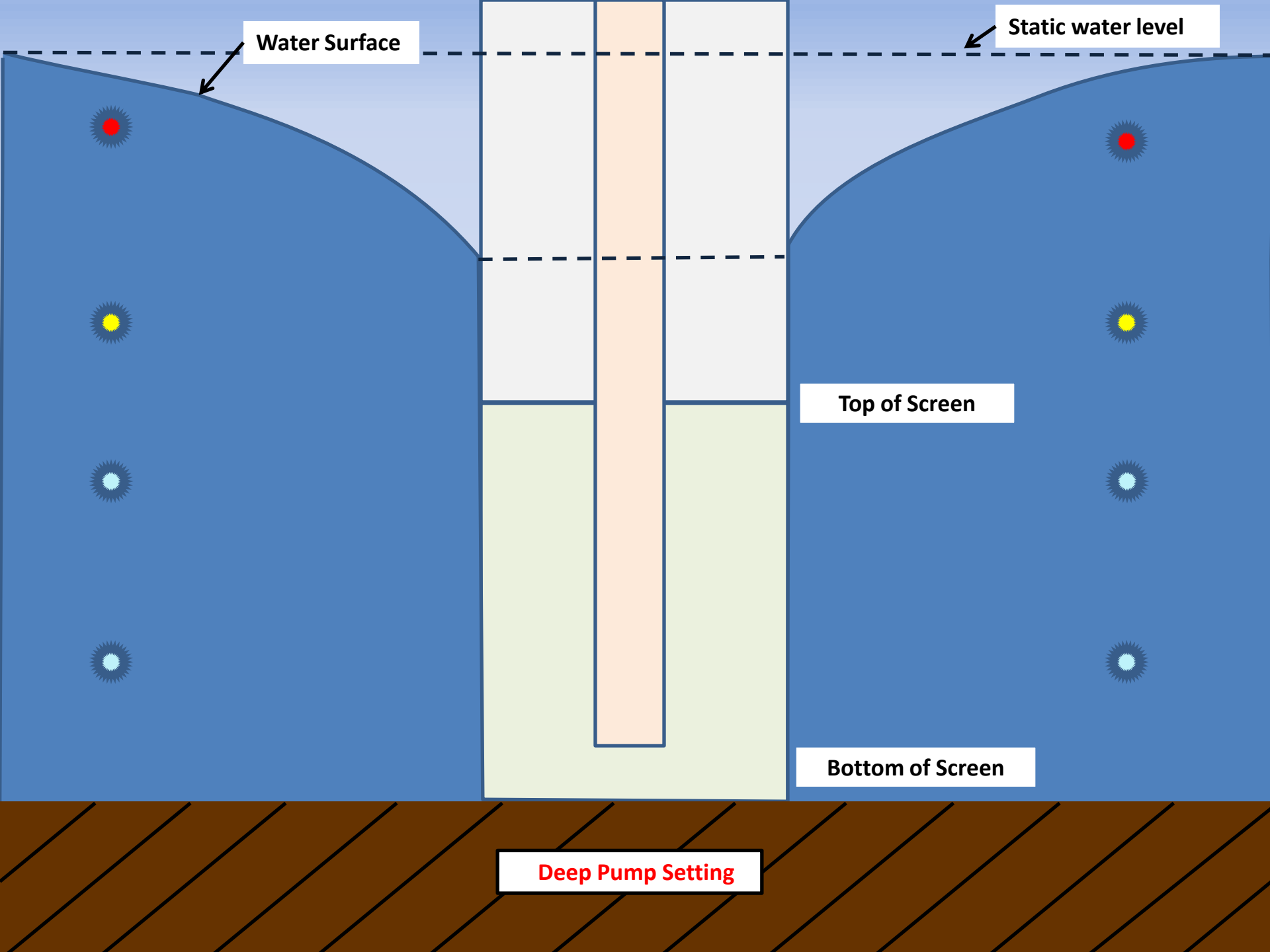

Water Surface
Static water level
Draw Down
Pumping level
Vertical Turbine (Main)
Top of Screen
Bottom of Screen
Deep Pump Setting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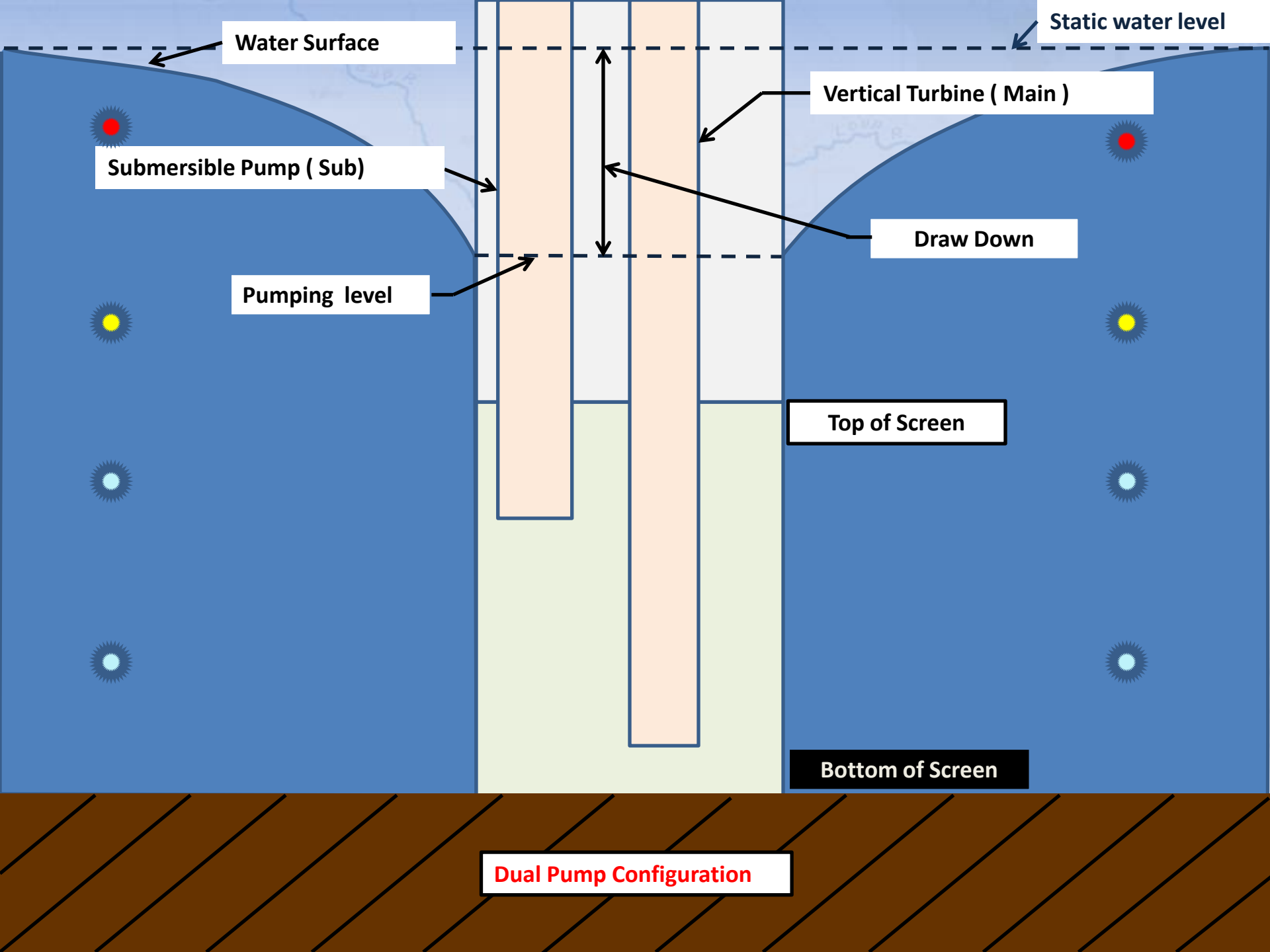
Deep Pump Setting


Static water level
Water Surface
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Submersible Pump (Sub)
Draw Down
Pumping level
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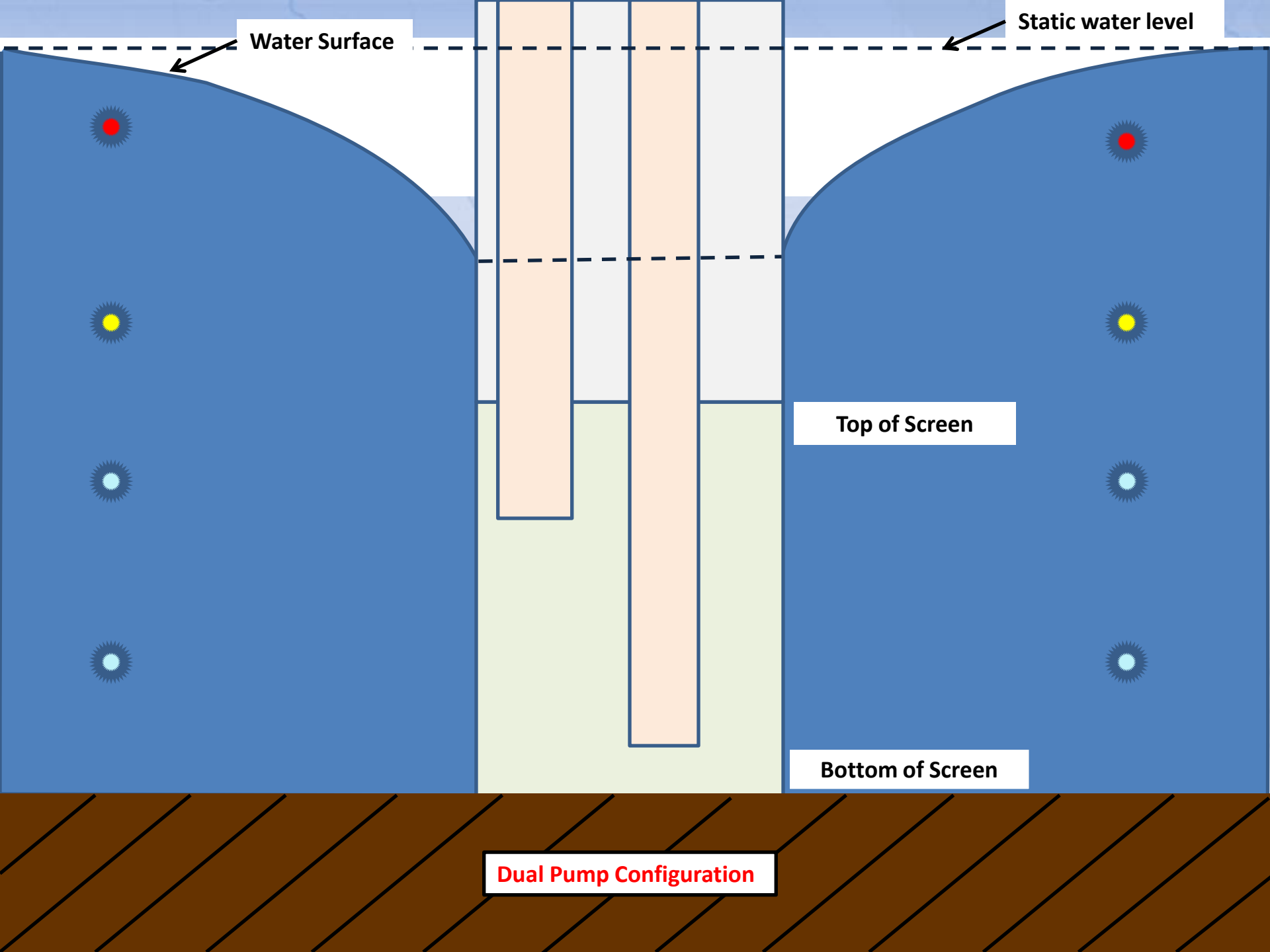
Dual Pump Configuration

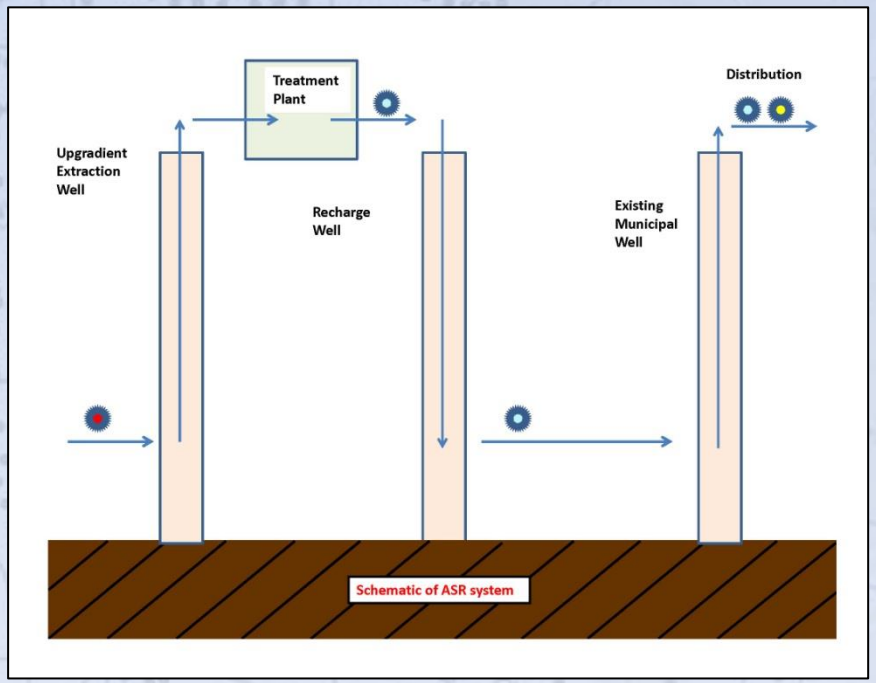

Water Surface
Static water level
Top of Screen
Bottom of Screen
Dual Pump Configuration

Implementation of a Dual Pump System

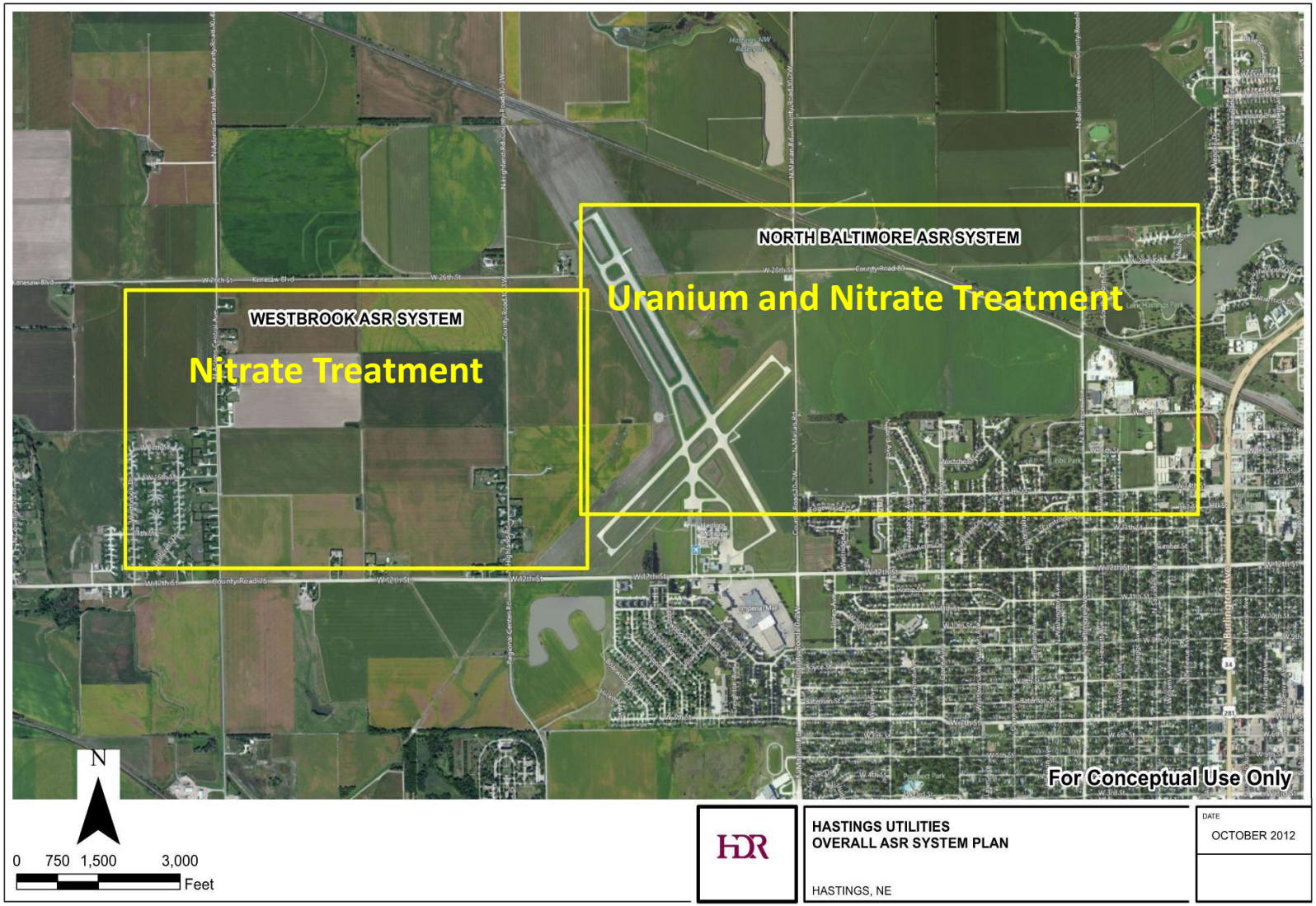
- Low Volume/High Concentration Raw Water can be Intercepted by a Second Pump Installed in a Municipal Well
- Concept Can be Applied in the Design of Future Wells or by Modifying Existing Wells
- Dual Pump is a Viable Alternative
  - Reduce Volume of Water Requiring Treatment
  - Reduce Capital Improvement and O&M Costs

Aquifer Storage and Restoration - Concept

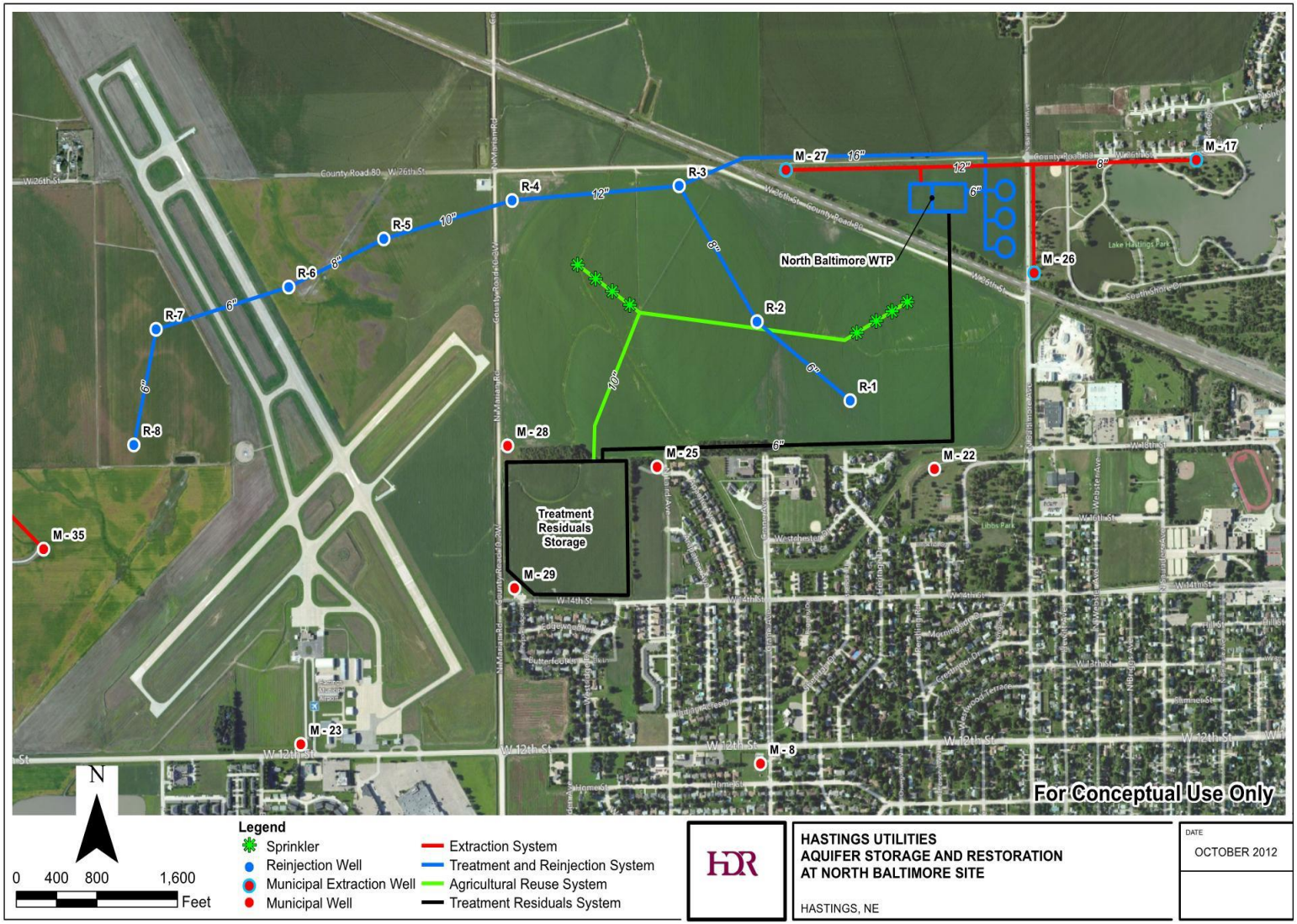
- Protect Long Term Viability of Aquifer
- Key – Intercepting Contamination Up Gradient of City Well Field
- Treat with Reverse Osmosis and Returned to the aquifer
  - Recover using existing down gradient wells
- Blending and Storage within the Aquifer thus Delaying Storage
- Retains use of Existing Wells



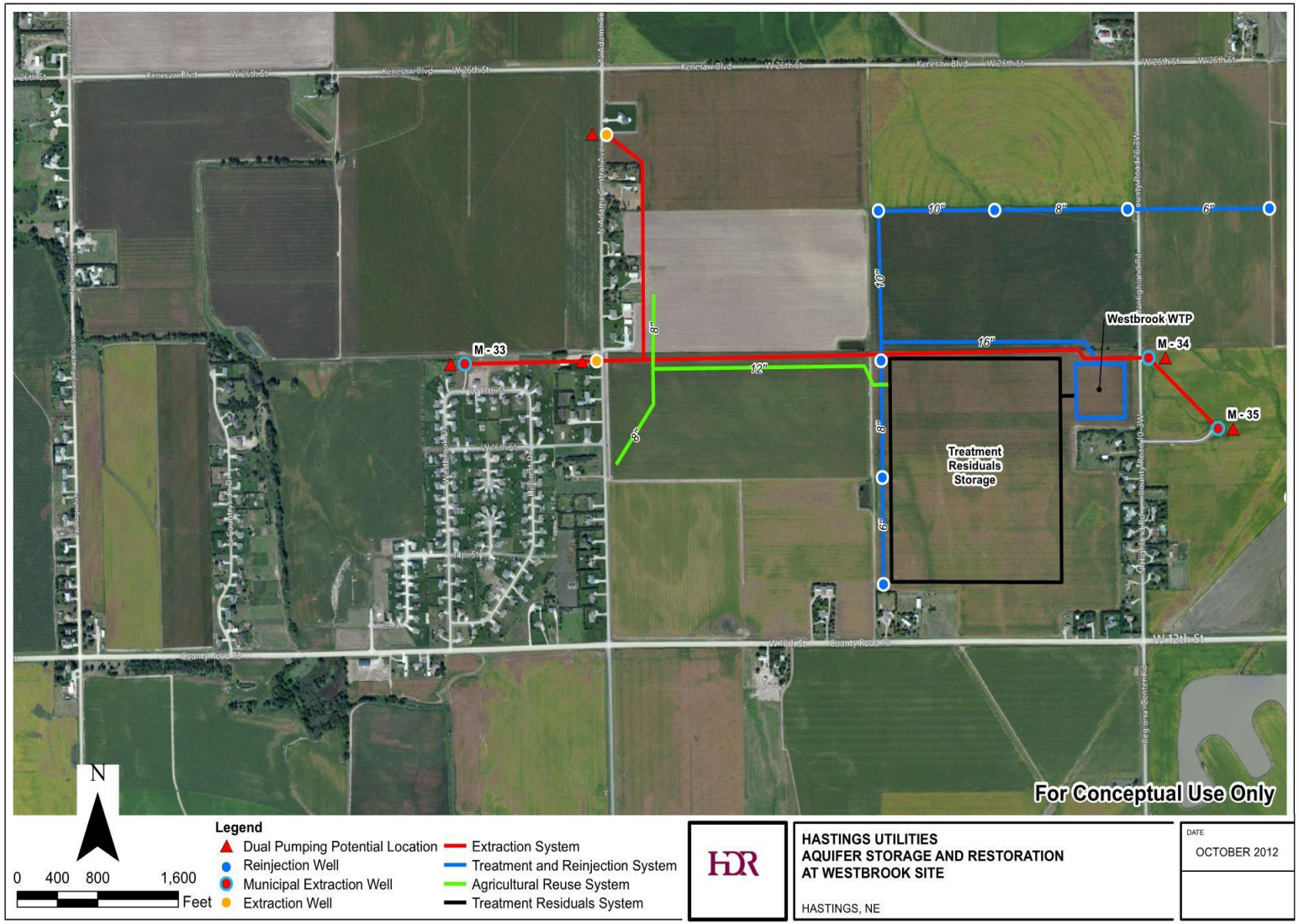
Overall ASR System Approach



North Baltimore System Conceptual Site Plan



Westbrook System
Conceptual Site Plan



Treatment and Residuals Disposal

- Modular Approach to Treatment – Add on as Needed
- Uranium Treatment
  - Uranium adsorptive media with disposal in licensed facility
- Nitrate Treatment
  - Reverse osmosis
- RO Residuals
  - 325 gpm to Sewer (25% of PCF Treatment Capacity)
  - Remainder to Evaporation and Irrigation
    - Approximately 40 acres required at North Baltimore Site
    - Pump up to 1,500 gpm for agricultural reuse during summer months

Irrigation Reuse and Management

- Protects Stored ASR Water for Potable Use
- Beneficially disposes of Nitrates by Agricultural Production

Water Treatment - Blending

- Blending of Several Wells to lower the Nitrate level in the Potable Water prior to delivery into the Water Distribution System - Water Storage Reservoirs

Overall Plan Costs

Phase	Description	Base Estimated Construction Cost
Pilot	ASR and Dual Pumping System Pilots	$ 2,132,000
I	North Baltimore ASR System	$ 20,636,000
II	Westbrook ASR System	$ 16,415,000
III	Storage and Blending at North Baltimore Site	$ 6,728,000
	Total Estimated Construction Cost	**$ 45,911,000**

This plan carries some risk. It is a new concept. The projects will be staged such that if full water treatment is required it can be installed with limited duplication of costs. Does not include lost treatment capacity at Wastewater Treatment Plant.

HU Board Concerns

- Future Potable Water Supply is threatened by activities outside the City of Hastings' control
- The proposed cost of water treatment is too high and threatens the City of Hastings' and the surrounding communities' economic viability

Regional Concerns

- Nitrates is a regional issue impacting other water system such as the Village of Juniata, Prosser, Kenesaw, Glenvil, Trumbull, Inland, Adam Central Schools and the Hastings Regional Center
- The Hastings Water System may be needed to develop a Adams County Rural Water System

Policy Questions

- Based upon the recent 130 years of water system operation, the Citizens of Hastings have come to expect access to potable water. Is the right to use groundwater only a quantity issue or does it imply a reasonable expectation for potable quality?

Fisher Fountain was dedicated as a sign of Hope during the Dust Bowl years

Questions?

HASTINGS UTILITIES

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