01-13-2026

Monthly Meeting

Drinking Water and Wastewater

Regional Water Supply and Watershed Management Study

Town of Truro
Town of Provincetown

DRAFT Interim Findings
Regional Water Study – Technical Team Meeting
January 13, 2026

Agenda

1. Desktop Study
2. Groundwater Modeling
3. Cost Estimates
4. Site Rankings and Conclusions
5. Water Demands
6. Discussion

1 Desktop Study

Desktop Study

- 33 potential well sites were identified during the preliminary desktop study
- Preferred sites were selected based on review feedback from the Provincetown - Truro team
- 7 Potential Public Water Supply Sites identified for further assessment and modeling include:
  - NTAFB Wells (included in original model)
  - Highland Road
  - Walsh Site A
  - Quail Ridge Site B
  - Long Nook Road Site
  - Site C-5 (included in original model)
  - Prince Valley Road

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2 Groundwater Modeling

APEX

Groundwater Model – Scope

1. Update Pamet Lens Model, Add Chequesset Lens, Update Pamet River Model Conditions, Incorporate 7 proposed potential public water supply sites.
2. Model each source separately to evaluate potential salinity impacts, impacts to sensitive receptors (Pamet River), area of contribution, and protection of water quality at North Union Wellfield.
3. Conduct up to two additional modeling scenarios based on individual well results.
4. Run model to evaluate potential impacts to public water supply wells associated with future Sea Level Rise – (1, 3, and 6 feet of sea level rise)

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Groundwater Model - Initial Analyses

Table 1. Seasonal Pumping Rates – Model Scenario 1

Source	Pumpage (gpd)	
	Winter Rate (Nov – Apr)	Summer Rate (May – Oct)
New Source	200,000	350,000
NTAFB	198,018	296,367
NUF-1	64,422	131,141
NUF-2	121,162	238,165
South Hollow	220,789	548,904
Knowles Crossing	68,689	139,090
Total Withdrawal	873,080	1,703,667

*NTAFB wells were included in all model scenarios using measured average rates, as well as an individual scenario with increased rates used for other potential well locations

- The Pamet Lens Model simulates seasonal pumping from PWS wells over a 100-year period (2012-2112)
- The model was updated to incorporate average pumping rates for existing water supply wells (based on pumping data from the last 5 years)
  - Summer Months: May through October
  - Winter Months: November through April
- NUF Total Pumping 185,584 gpd Winter and 369,306 gpd Summer. Permitted pumping rate 734, 000 gpd.
- Separate runs were performed for each potential well location, with rates for each set at
  - 350,000 gpd for summer
  - 200,000 gpd for winter
- New Source pumping rates selected to support Multi-Straw approach

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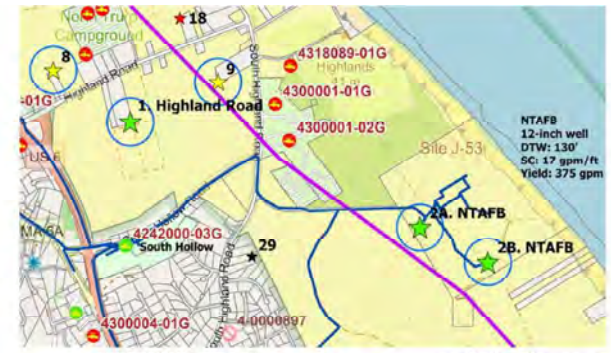
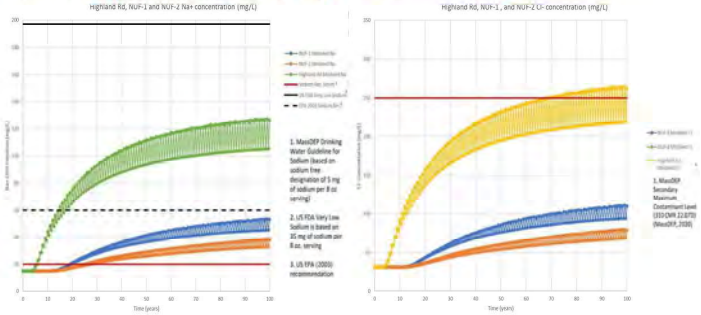
Model Results

Highland Road Site

- Within Water Rights Territory
- Two privately owned parcels located south of Highland Road
- Adjacent to the National Seashore
- Private parcels would require land acquisition from multiple owners
- Potential Impacts to South Hollow Wellfield Wells and NUF
- Potential saltwater upconing/intrusion due to thinner freshwater lens with location further from the center of the Pamet Lens
- Potentially viable at lower pumping rates.





Pumping Rates
Summer: 350,000 gpd
Winter: 200,000 gpd

Sodium

Chloride

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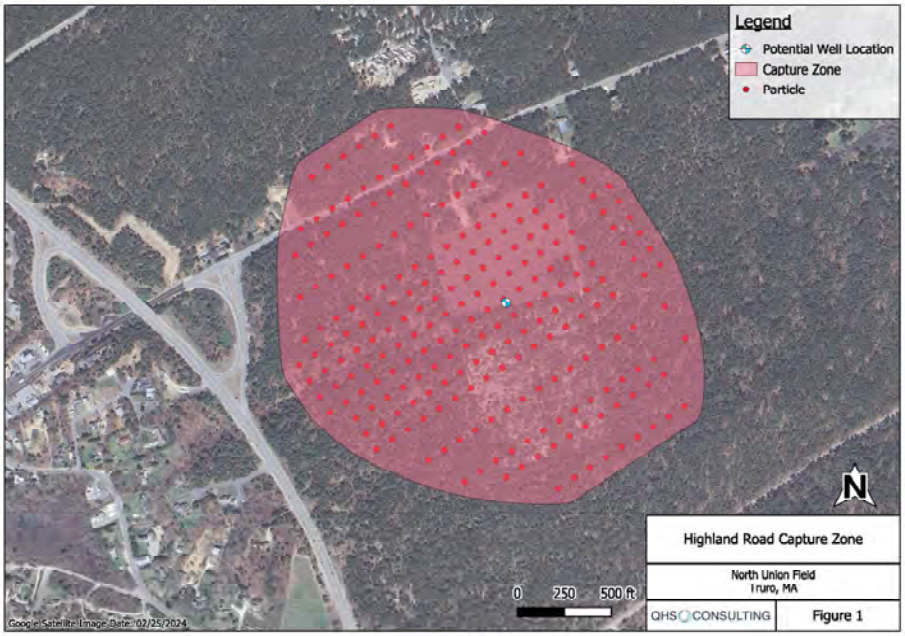
Area of Contribution – Highland Road



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NTAFB Wells

- Owned by NPS CCNS
- Estimated safe yield of 0.57 MGD
- Would require agreement with NPS for use of wells
- No assessment to date of water quality impacts
- Potential Impacts to NUF Wellfield Wells
- Furthest east – potential saltwater upconing/ lateral intrusion due to thinner freshwater lens and proximity to Atlantic Ocean
- NTAFB Well #5 closer to the coast than Well #4
- Supplemental seasonal usage at lower pumping rates could be further evaluated

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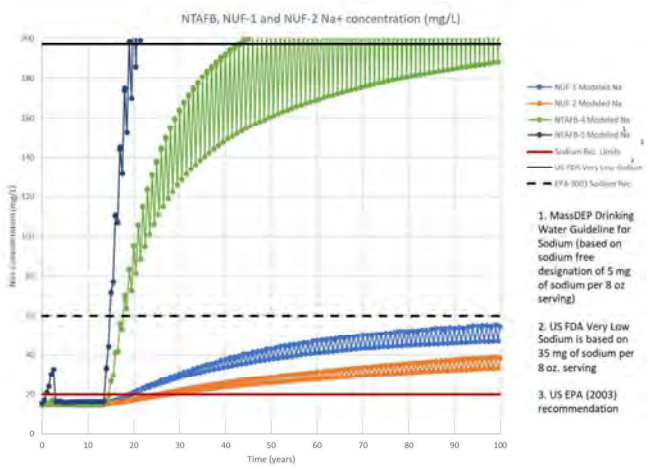
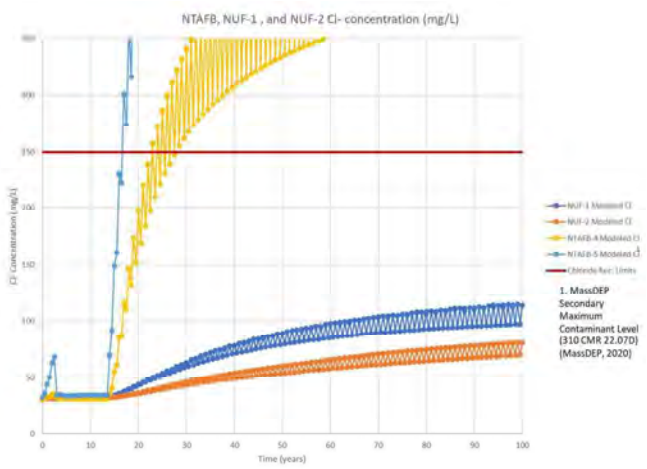
Results – NTAFB Wells (same scale as other sites)

Pumping Rates
Summer: 350,000 gpd
Winter: 200,000 gpd



Sodium



Chloride

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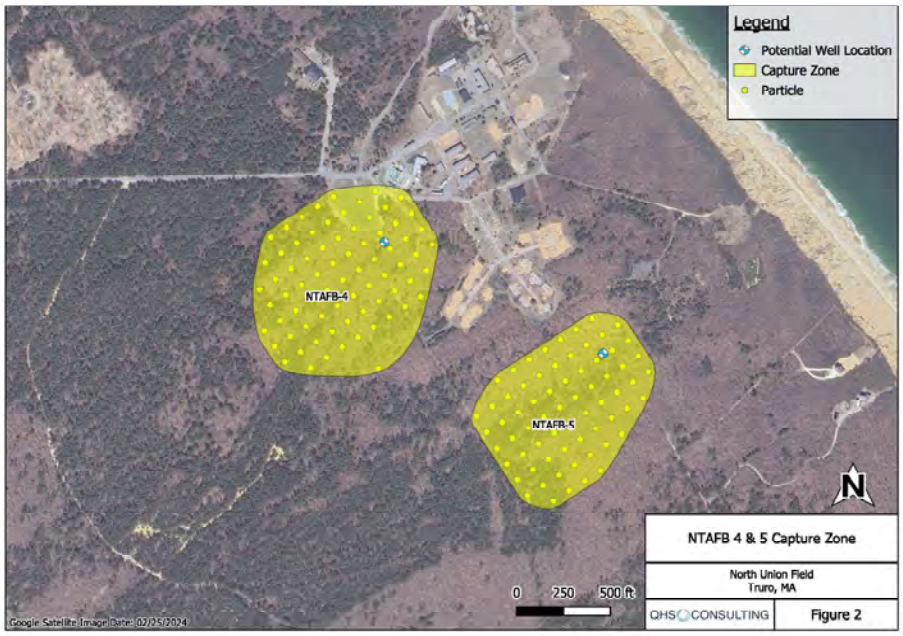
Area of Contribution – NTAFB Wells



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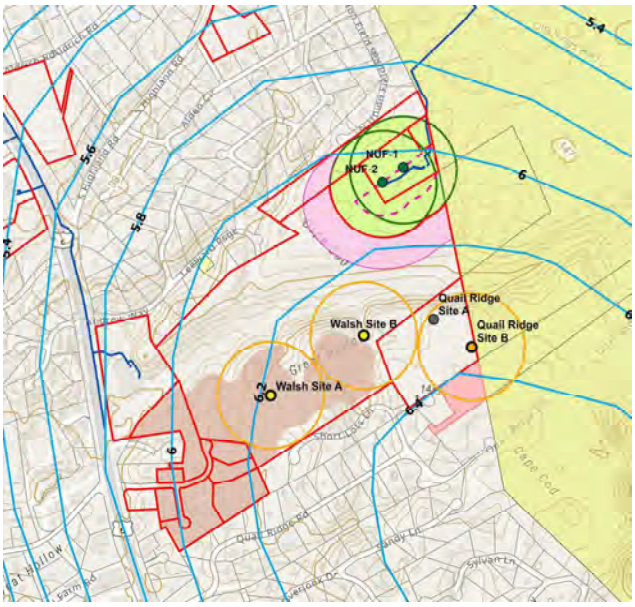
Results – Quail Ridge B

- Owned by Town of Truro
- Requires acquisition of or easement with parcels to south (Ziller Path) for Zone I compliance
- Previously assessed Quail Ridge Site A
- Interference with NUF Wells and saltwater upconing at higher pumping rates
- Located higher on the Pamet Lens than NUF
- Pumping this site at a lower pumping rate in combination with another source may be a viable alternative



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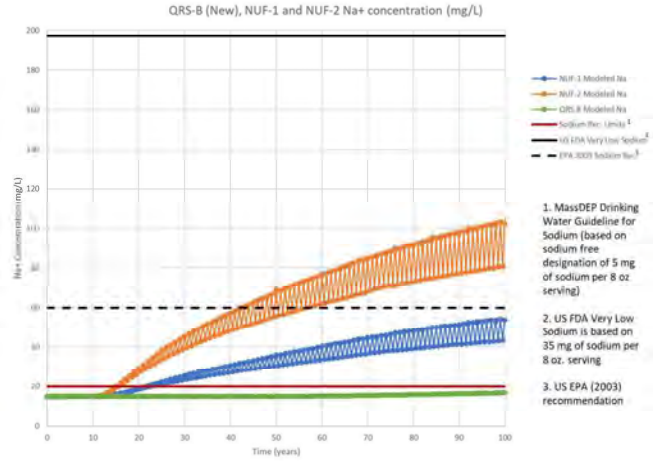
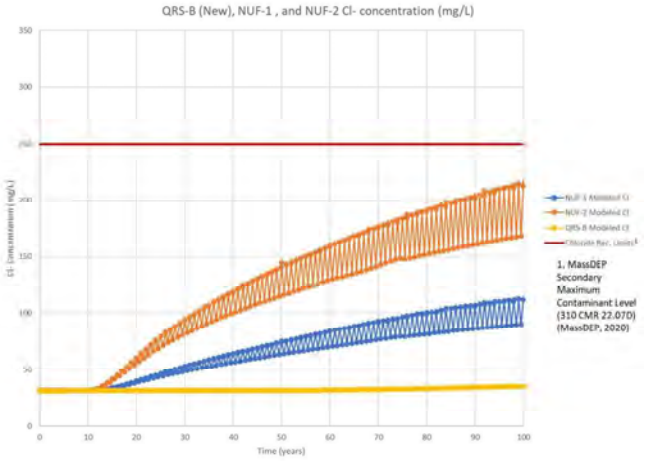
Results – Quail Ridge B

Pumping Rates
Summer: 350,000 gpd
Winter: 200,000 gpd



Sodium



Chloride

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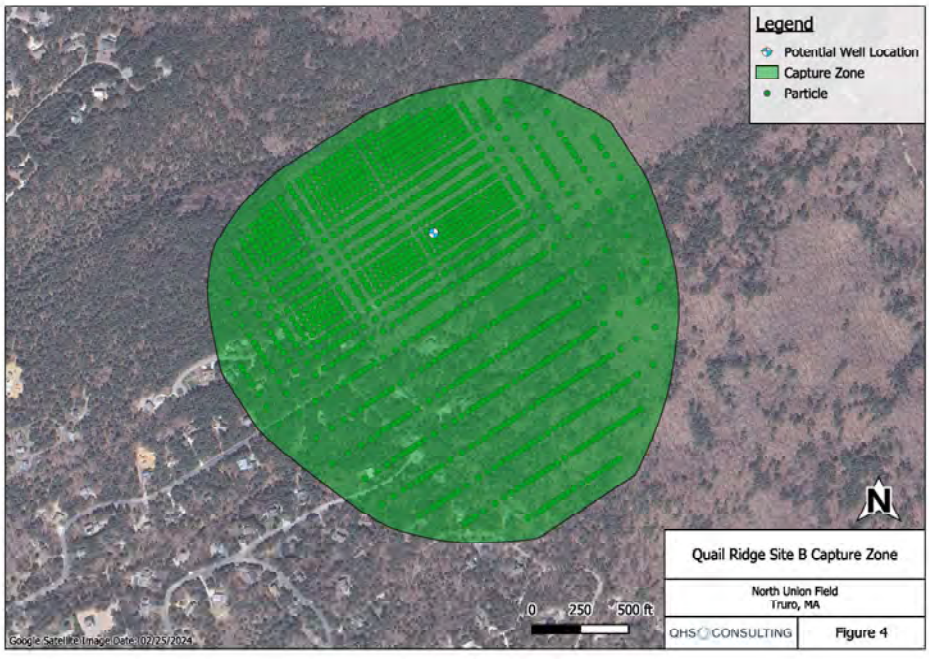
Area of Contribution – Quail Ridge B

Pumping Rates
Summer: 350,000 gpd
Winter: 200,000 gpd



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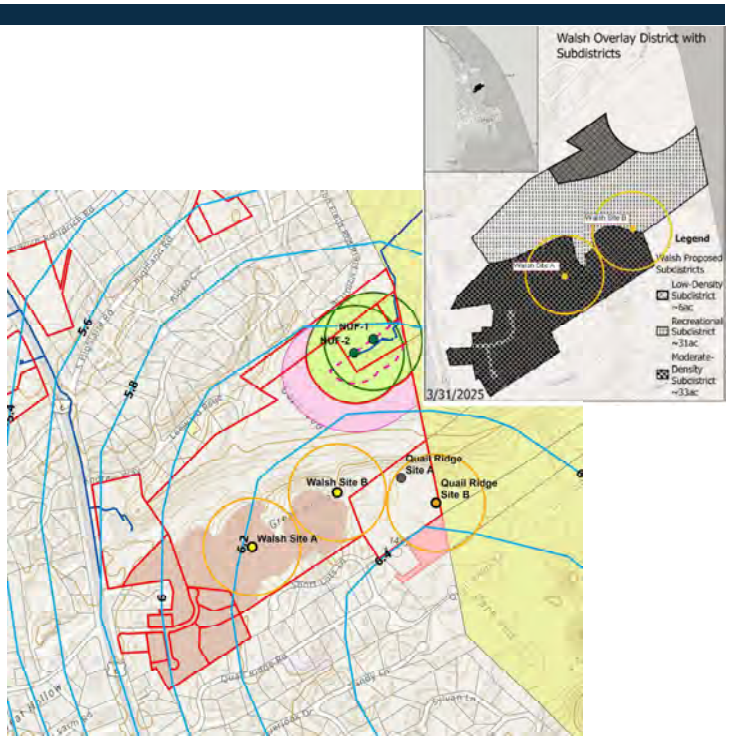
Results – Walsh Site A

- Apex identified two potential sites Walsh Site A and B
  - Location A is as far from NUF as possible on the west side of the Pamet Lens (1,800 feet southwest of NUF-2)
  - Location B is closer to NUF and outside of the proposed development area (1,100 feet southwest of NUF-2)
- Walsh Site A selected for modeling because the site is located higher on the Pamet Lens and on the Cape Cod Bay side of the lens, suggesting less impacts to NUF wellfield
- Model results show less impact to NUF Wells than Quail Ridge B



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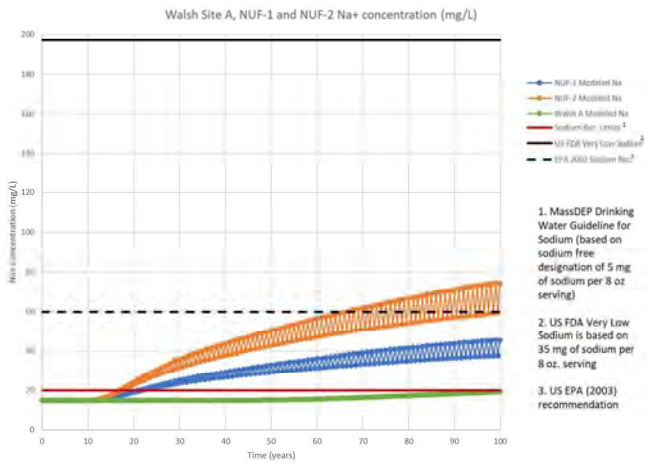
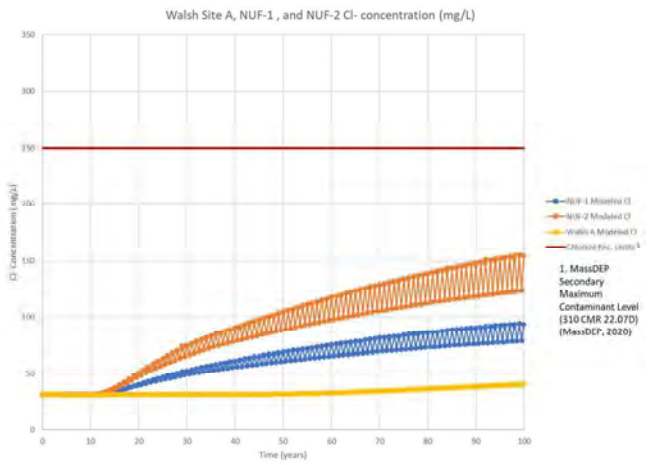
Results – Walsh Site A

Pumping Rates
Summer: 350,000 gpd
Winter: 200,000 gpd



Sodium



Chloride

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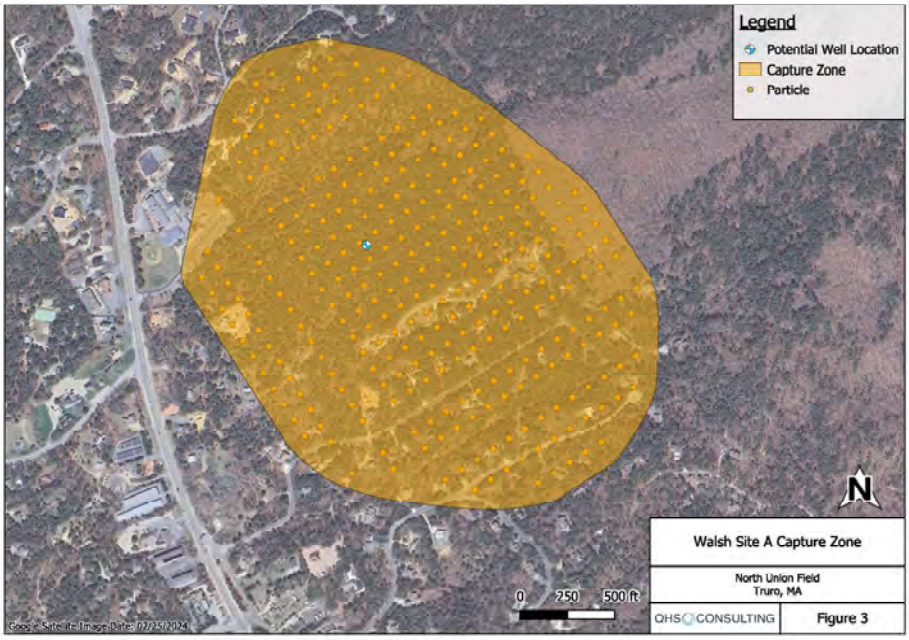
Area of Contribution – Walsh Site A

Pumping Rates
Summer: 350,000 gpd
Winter: 200,000 gpd



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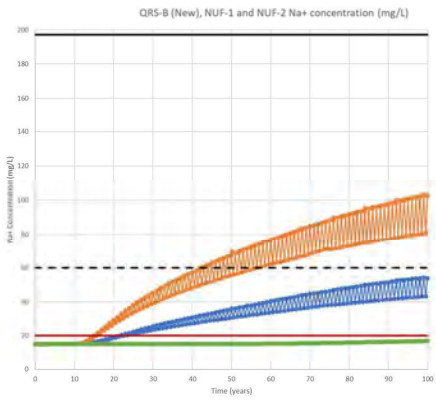
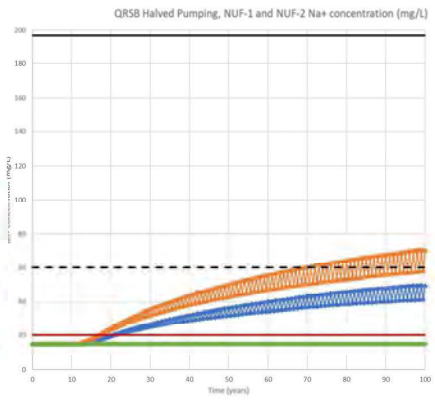
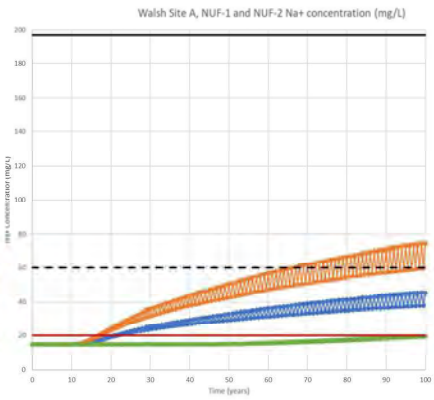
Comparison – Walsh Site A and Quail Ridge B – Sodium Concentrations



Quail Ridge B Pumping
350,000 gpd Summer
200,000 gpd Winter



Quail Ridge B Pumping
175,000 gpd Summer
100,000 gpd Winter



Walsh Site A Pumping
350,000 gpd Summer
200,000 gpd Winter

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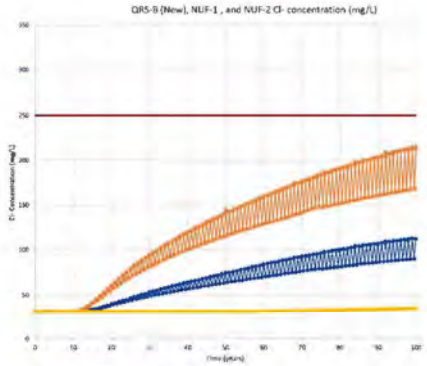
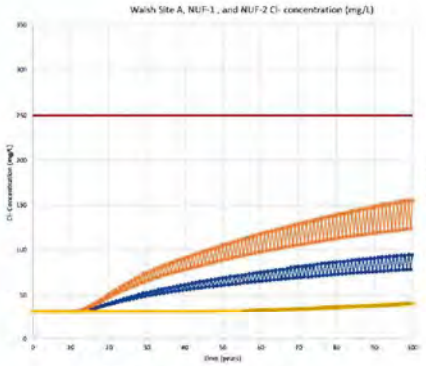
Comparison – Walsh Site A and Quail Ridge B – Chloride Concentrations



Quail Ridge B Pumping
350,000 gpd Summer
200,000 gpd Winter

Quail Ridge B Pumping
175,000 gpd Summer
100,000 gpd Winter



Walsh Site A Pumping
350,000 gpd Summer
200,000 gpd Winter

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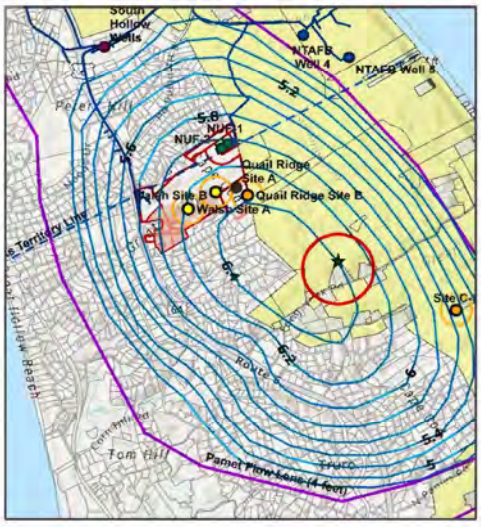
Long Nook Road Site

- Privately owned parcel. The northern part of the parcel appears undeveloped with a structure located on the southern part of the property close to Long Nook Road.
- The parcel is surrounded by National Seashore to the north.
- A well could be located greater than 400 feet from the structure on undeveloped land .
- There is a privately owned parcel to the southwest that would require ownership/easement for the undeveloped portion within the Zone I.
- Potential impacts to Pamet River, NUF, and Site C-5 need to be assessed.
- Previous studies by Apex/EP indicate Little Pamet River is underlain by peat and would have little impact from pumping at Long Nook Road Site but this would need to be confirmed with additional field assessment.



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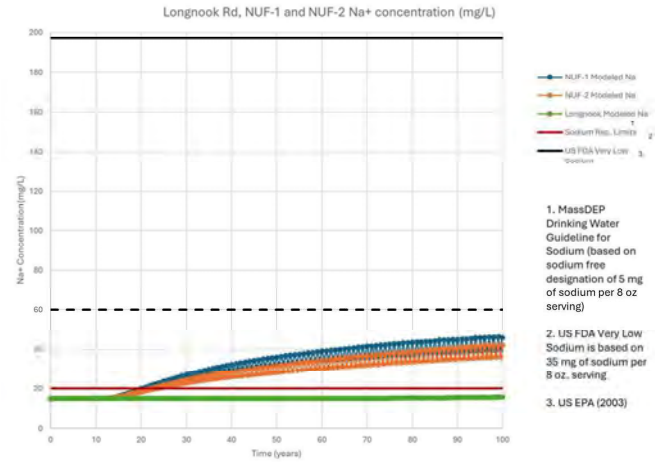
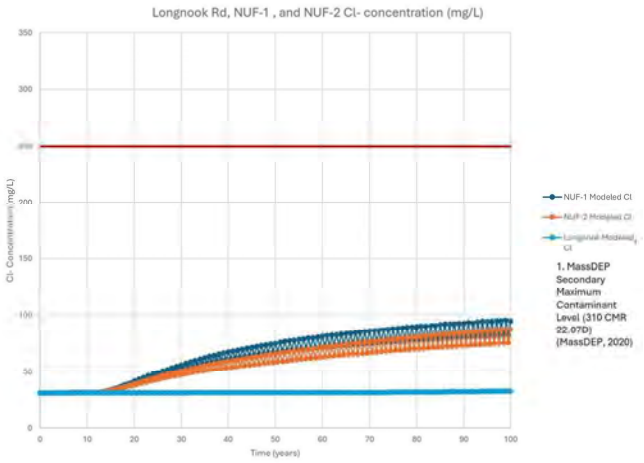
Results - Long Nook Road Site

Pumping Rates
Summer: 350,000 gpd
Winter: 200,000 gpd



Sodium



Chloride

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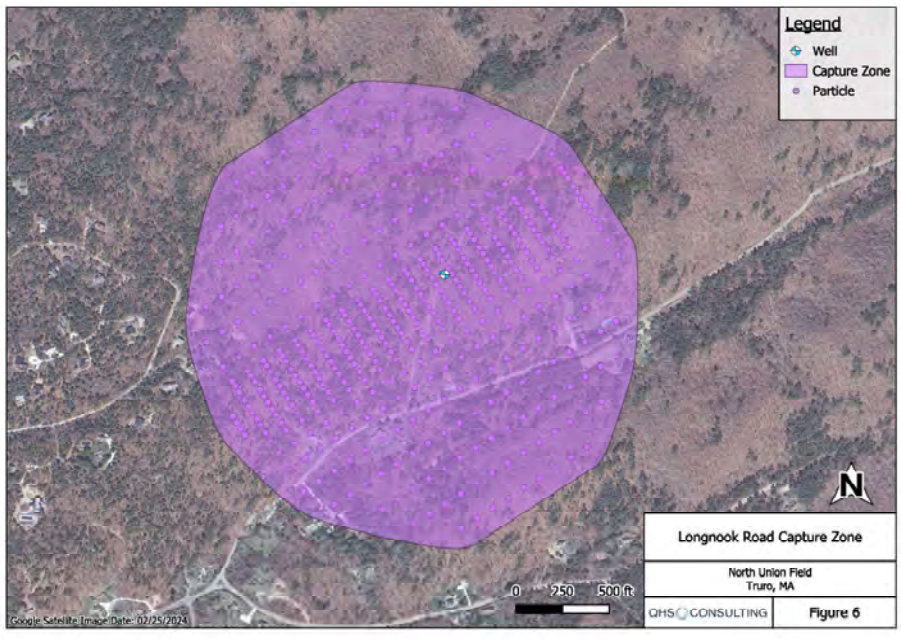
Area of Contribution – Long Nook Road

Pumping Rates
Summer: 350,000 gpd
Winter: 200,000 gpd



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Results – Site C-5

- Confirm ownership by the Town of Truro
- Parcel surrounded by National Seashore
- Drilling, testing, and preliminary modeling performed by EP/Apex in 2002-2004
- Modeling of pumping impacts from saltwater upconing/ intrusion indicates potential withdrawal of 450,000 gpd
- Approvable well yield may be limited by potential impacts to Pamet River
- Potential well yield after Pamet River Restoration needs to be modeled

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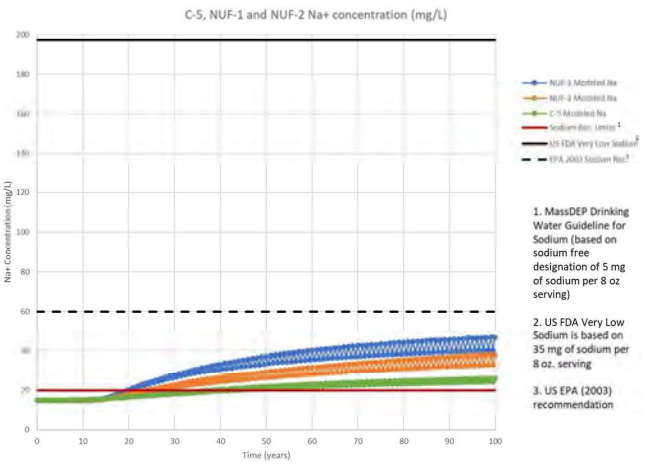
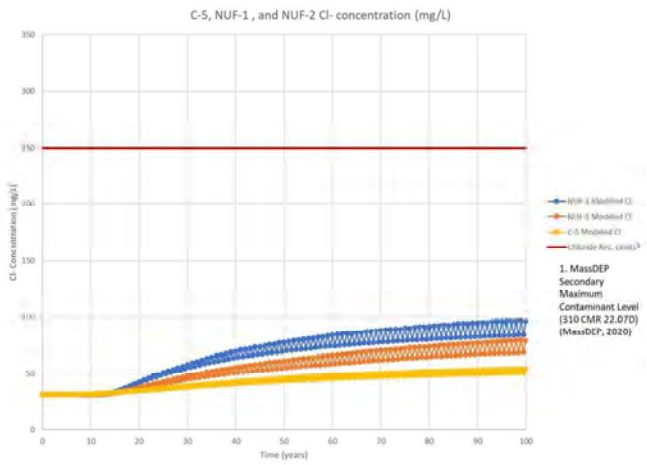
Results – C5 Site

Pumping Rates
Summer: 350,000 gpd
Winter: 200,000 gpd



Sodium



Chloride

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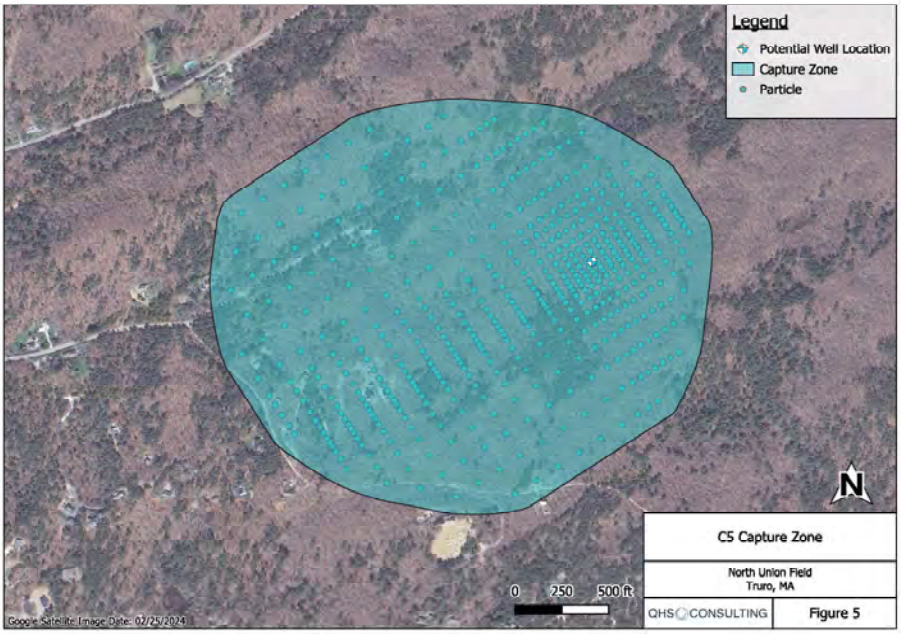
Area of Contribution – Site C-5

Pumping Rates
Summer: 350,000 gpd
Winter: 200,000 gpd



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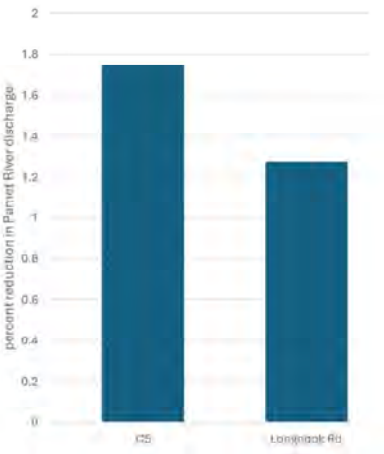
Potential Reductions to Modeled Pamet River Discharge – Site C-5 and Long Nook Road



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Model Results – Comparison of Drawdown and Sodium and Chloride Concentrations NUF, Long Nook Road, Site C-5, Walsh Site A, and Quail Ridge B

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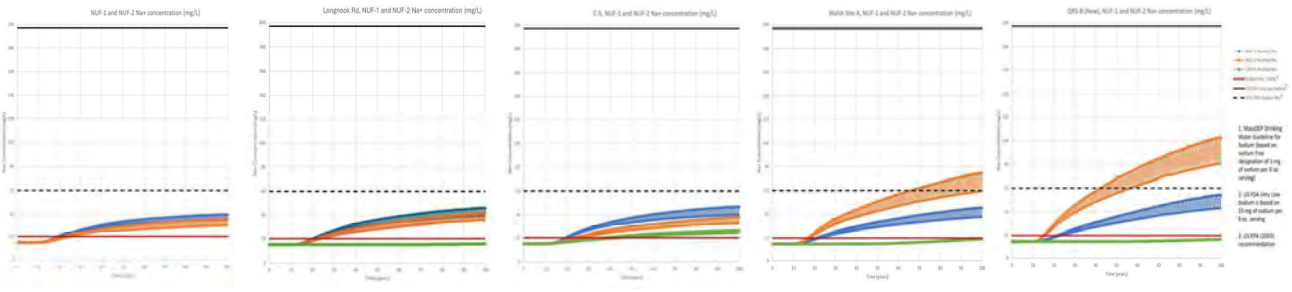
Modeled Sodium Concentrations – Comparison

NUF | Long Nook Road | Site C-5 | Walsh Site A | Quail Ridge B



NUF Pumping
369,306 gpd Summer
185,584 gpd Winter

Other Individual Sites
350,000 gpd Summer
200,000 gpd Winter

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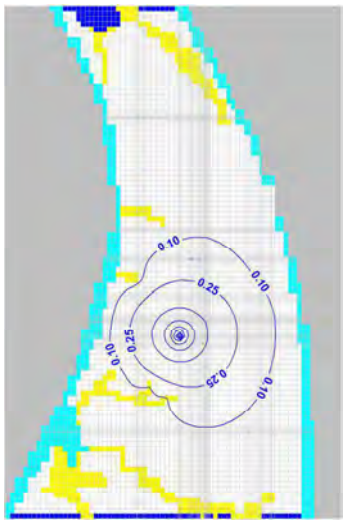
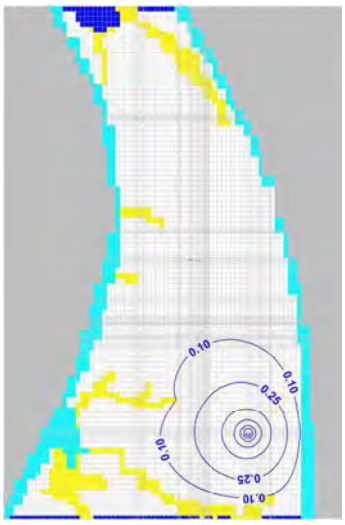
Modeled Drawdown – Comparison Pumping

350,000 gpd Summer
200,000 gpd Winter

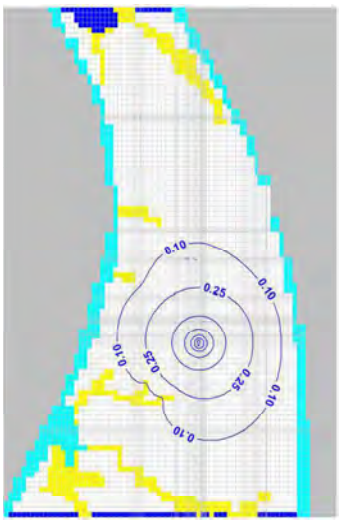
Walsh Site A



C-5



Quail Ridge B



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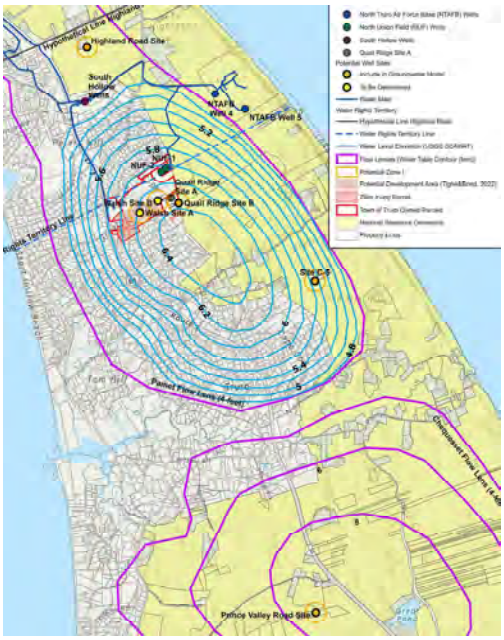
Results – Prince Valley Road Site

- Located within the Chequesset Flow Lens
- Confirm ownership by the Town of Truro
- Undeveloped land surrounded by the National Seashore
- Further from the coast (lower concern for saltwater intrusion/ up-coning)
- Spreads out the withdrawals and promotes the multi straw approach
- Located far from existing water infrastructure (approx. 3.7 miles)
- Potential concerns to assess:
  - Potential pumping impacts to Pamet River
  - Potential pumping Impacts to Great Pond, Snow Pond and Ryder Pond
  - Potential PFAS water quality impacts from Closed Landfill



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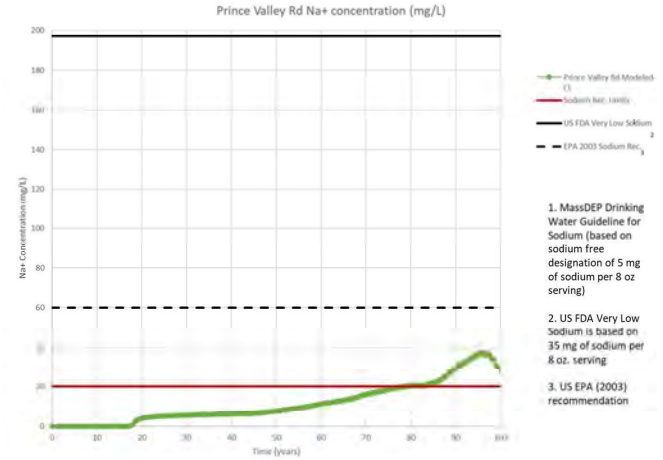
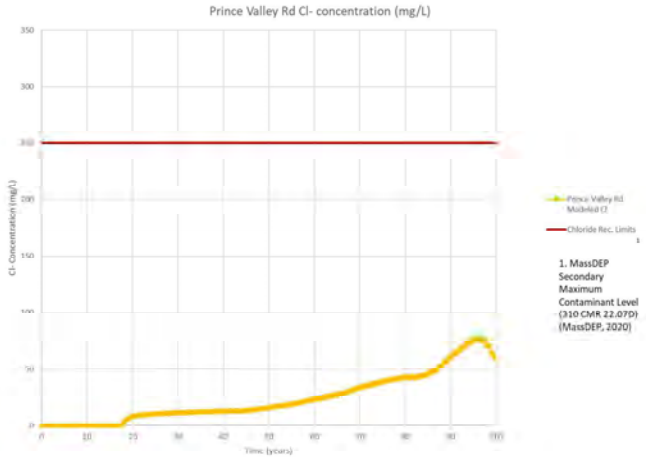
APEX COMPANIES, LLC

Results – Prince Valley Road Site

Pumping Rates
Summer: 350,000 gpd
Winter: 200,000 gpd



Sodium



Chloride

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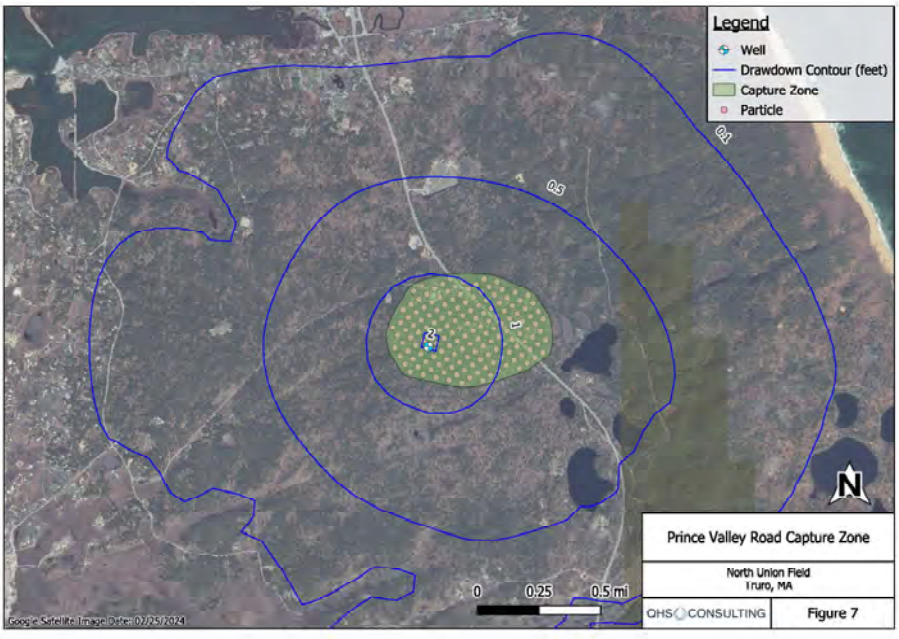
Area of Contribution – Prince Valley Road



Pumping Rates
Summer: 350,000 gpd
Winter: 200,000 gpd

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3 Cost Estimates

Cost Estimate Summary		
Walsh A	$	6,180,000
Quail Ridge B	$	6,480,000
Long Nook Road	$	8,680,000
C-5	$	9,030,000
Prince Valley	$	13,430,000

Costs Include

- Wells and Well Pump Station, Production Wells, and Appurtenant Work
- 8-inch Ductile-Iron Water Main, Class 50 Pipe (Local Roads)
- 8-inch Ductile-Iron Water Main, Class 50 Pipe (Route 6)
- Police Detail for Installation on Route 6 (Two Officers)
- Electrical Service

Costs do NOT include

- Land Purchase
- Extensive Treatment

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4 Site Rankings and Conclusions

Potential Water Supply Site Rankings Interim Findings - Individual Model Runs

Site Ranking Evaluation - Provincetown Truro Watershed Study

Evaluation Criteria	Potential Water Supply Sites in Truro				
	Walsh Site A	Long Nook Road	Site C-5	Prince Valley Road (Preliminary)	Quail Ridge B
Saltwater Upconing (1)	3	3	3	3	3
Potential Withdrawal Capacity	2	3	2	3	1
Impacts to Existing Sources (NUF)	2	3	3	3	1
Sensitive Environmental Receptors	3	2	2	2	3
Resiliency /Sea Level Rise (Preliminary)	3	3	2	3	3
Proximity to System/Cost to Develop	3	2	2	1	3
Potential for Contamination Sources	3	3	3	2	3
Site Ranking	**19**	**19**	**17**	**17**	**17**
Land Ownership (Owned by Truro)	3	1	2	3	1
Site Ranking (including Land Ownership)	**22**	**20**	**19**	**20**	**18**

Notes: Ranking Criteria are all weighted equally.
(1) Assumes pumping at 350,000 gpd Summer/200,000 gpd Winter

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Interim Findings

1. A detailed desktop study was conducted to identify parcels that are large enough to support a MassDEP required 400-foot Zone I. This study included both Town-owned and private parcels.
2. A total of 33 locations were identified that could support ownership or control of the MassDEP required 400-foot Zone I.
3. Average summer pumping rate for NUF has been 369,306 gpd. NUF Approved Pumping Rate is 734,000 gpd. Possible additional available water at NUF.
4. Potential water supply sites selected for groundwater modeling include 6 within the Pamet Lens aquifer and 1 within the Chequesset Lens aquifer.
5. Initial modeling results show Highland Road Site and NTAFB Site are not viable at the rate modeled due to limited freshwater lens resulting in saltwater upconing or lateral intrusion.
    i. NTAFB Site may be used seasonally or for emergency uses.
    ii. Highland Road Site may be viable at reduced pumping rate.
    iii. Additional modeling is required to assess pumping impacts on water quality and impacts to NUF and South Hollow Wellfields.
6. Three potentially viable PWS sites identified within Pamet Lens – Walsh Site A/Quail Ridge B, Long Nook Road, and Site C-5. Walsh Site A preferable to Quail Ridge B with less impacts to NUF water quality.

Interim Findings (continued)

4. Evaluations conducted in 2000 - 2004 identified two potentially viable PWS sites – Site C-5 and NUF (adjacent to Walsh Property). NUF was permitted as a new PWS source in 2011.
5. Two new source desktop studies within the Pamet Lens identified the same two parcels for PWS development. These results show that although there are a lot of potential PWS sites within the Pamet Lens, potentially viable new water supply sources are limited, and the two sites should be preserved for public water supply development.
6. To best preserve the Quail Ridge B Site or Walsh Property Site A, wastewater from any development on the Walsh Property should be directed outside of the area of contribution and Zone II for existing and potential well sites.
7. Due to the limited availability of potentially viable PWS sites, identified potential new sources and exiting water supply sources need to be protected from future impacts.
8. Next steps are to develop additional modeling scenarios to further evaluate viability of potential public water supply sites identified, combined water supply site pumping conditions, and potential impacts due to sea level rise.
9. Interim findings are based on groundwater modeling results. Field confirmation of subsurface geologic conditions and verification of modeled impacts are required for all sites to confirm suitability for public water supply development.

5 Water Demands

Water Demands Analysis Update

- Both Towns have provided information on future planned developments. Using historical per capita water demand and household composition data, future demands will be forecasted.

Provincetown

Projects Pending	Total Units
33 Conwell St.	16
27 Winthrop/34 Court St	6
22/R & 24 Nelson	60
288A Bradford	15
3 Jerome Smith Road (40B)	65
207 Rt. 6 Barracks *(+ 112 dorms)*	13
227R Commercial	4
307 Commercial	4
26 Shank Painter	40
44 Captain Bertie's	36
Total Projects Pending	259

Table from 2024 Community Housing Report

Truro

Table 2.6 Summary of Housing Developments Outlined in 2025 Truro Housing Production Plan

Development Location	Number of Units[1]
Walsh Property (Walsh Way)	160[1]
Clover Leaf (22 Highland Road)	39[2]
181 Route 6	3[2]
Location TBD	58[3]
Total	**260[4]**

Notes:
1. Number of units for the Walsh Property is from the February 2025 Memorandum from Cody J. Salisbury, Provincetown's superintendent.
2. Number of units for the Clover Leaf Property and 181 Route 6 is from the 2025 Truro Housing Needs Assessment and Production Plan.
3. Value was calculated by subtracting the number of units proposed in the Walsh Property, Clover Leaf, and 181 Route 6, from the total units needed (260, as outlined in the 2025 HPP).
4. Source: 2025 HPP

6 Discussion

01-08-2026

Provincetown Water and Sewer Board Meeting

Drinking Water and Wastewater

Regional Water Supply and Watershed Management Study – 1/8/2026

APEX

Agenda

1. Desktop Study
2. Groundwater Modeling
3. Cost Estimates
4. Site Rankings and Conclusions
5. Discussion

1 Desktop Study

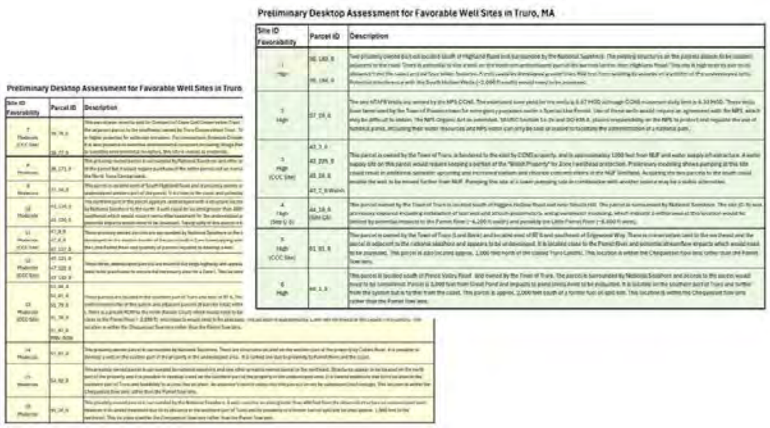
Potential New Source Water Supply Sites

- Apex conducted a preliminary desktop assessment of potential new source water supply sites
- Sites were ranked based on:
  - Ability to obtain ownership/control of MassDEP 400-foot Zone I
  - Potential for saltwater intrusion/up-coning
  - Proximity to sensitive environmental receptors (i.e., Pamet River or Little Pamet River, kettle ponds, etc.)
  - Distance from existing system
  - Potential interference with existing wells
- The Town of Truro and Town of Provincetown provided review comments and feedback on favorable sites
- **Ranking – High, Moderate, or Low**

Potential New Source Water Supply Sites

Potential New Source Sites

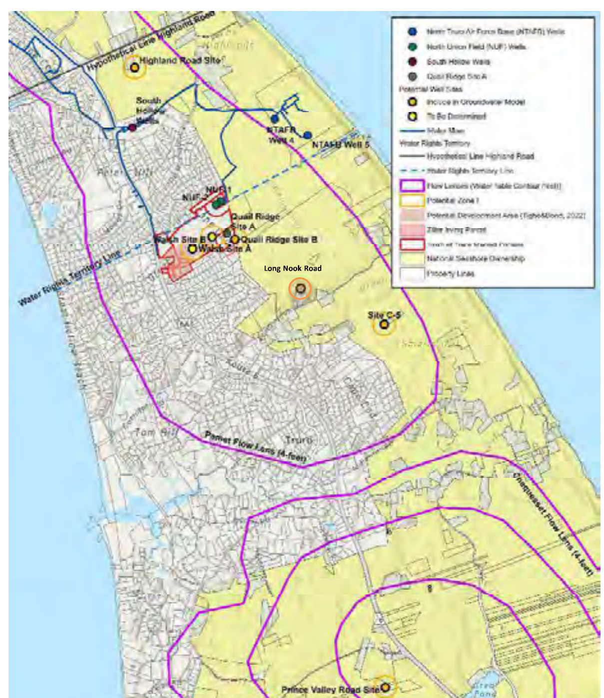
- 33 sites were identified during the preliminary desktop study
- Preferred sites selected based on review feedback from the Provincetown - Truro team



Recommended Sites for Further Assessment

Potential Public Water Supply Sites identified for further assessment and modeling include:

- NTAFB Wells (included in original model)
- Highland Road
- Walsh Site A
- Quail Ridge Site B
- Long Nook Road Site
- Site C-5 (included in original model)
- Prince Valley Road

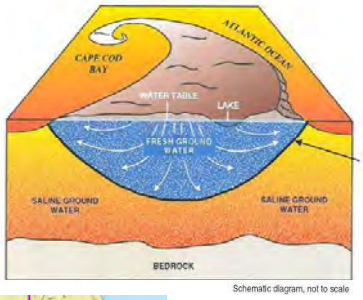


2 Groundwater Modeling

Groundwater Model – Scope

1. Update Pamet Lens Model, Add Chequesset Lens, Update Pamet River Model Conditions, Incorporate 7 proposed potential public water supply sources.
2. Model each source separately to evaluate potential salinity impacts, impacts to sensitive receptors, and protection of water quality at North Union Wellfield.
3. Conduct up to two additional modeling scenarios based on individual well results.
4. Run model to evaluate potential impacts to public water supply wells associated with future Sea Level Rise – (1, 3, and 6 feet of sea level rise)

Groundwater Model – Overview



Schematic diagram, not to scale

7 Potential Water Supply Sites Modeled

1. Modeled Pumping Conditions
2. Modeled Salinity Impacts (saltwater upconing or lateral intrusion) – At Potential Well Locations and NUF Wells 1 and 2
3. Modeled Potential Reductions in Discharge to Pamet River
4. Modeled Zone of Contribution Map (under normal pumping conditions)

Groundwater Model - Initial Analyses

Table 1. Seasonal Pumping Rates – Model Scenario 1

Source	Pumpage (gpd)	
	Winter Rate (Nov – Apr)	Summer Rate (May – Oct)
New Source	200,000	350,000
NTAFB	198,018	296,367
NUF-1	64,422	131,141
NUF-2	121,162	238,165
South Hollow	220,789	548,904
Knowles Crossing	68,689	139,090
Total Withdrawal	873,080	1,703,667

*NTAFB wells were included in all model scenarios using measured average rates, as well as an individual scenario with increased rates used for other potential well locations

- The Pamet Lens Model simulates seasonal pumping from PWS wells over a 100-year period (2012-2112)
- The model was updated to incorporate average pumping rates for existing water supply wells (based on pumping data from the last 5 years)
  - Summer Months: May through October
  - Winter Months: November through April
- Separate runs were performed for each potential well location, with rates for each set at
  - 350,000 gpd for summer
  - 200,000 gpd for winter
- New Source pumping rates selected to support Multi-Straw approach
- Model impacts to Pamet River flow from well pumping

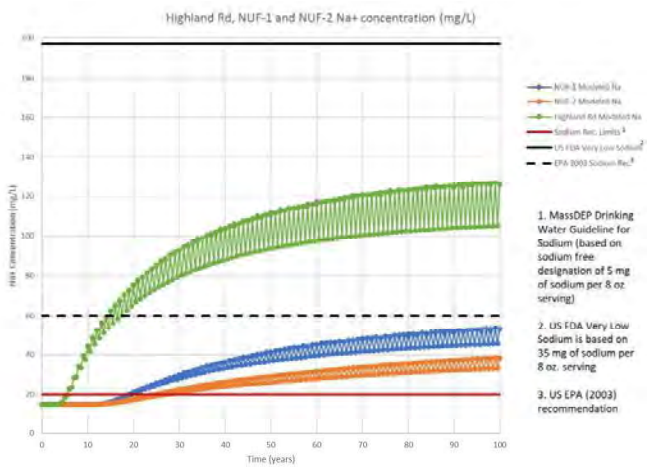
Model Results

Model Results – Highland Road Site and NTAFB Wells

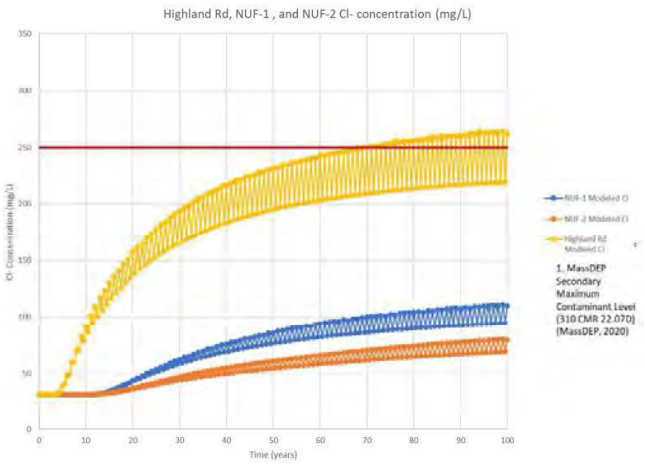
Highland Road Site

- Alternative – Two privately owned parcels located south of Highland Road
- Undeveloped land on the southern portion of these parcels for Zone I
- Adjacent to the National Seashore
- Farther from the coast and no nearby surface water bodies
- Private parcels would require land acquisition from multiple owners
- Potential Impacts to South Hollow Wellfield Wells
- Furthest north – Potential saltwater upconing/intrusion due to thinner freshwater lens

Results – Highland Road



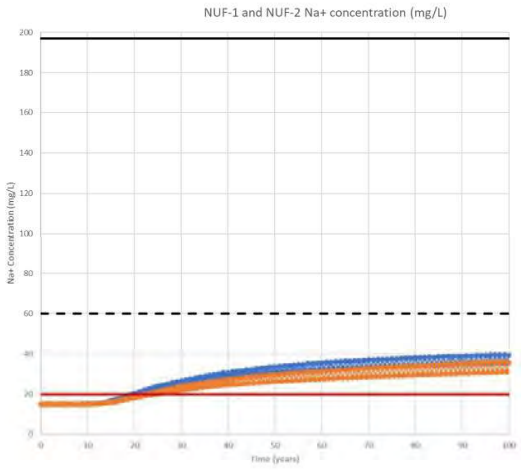
Sodium



Chloride

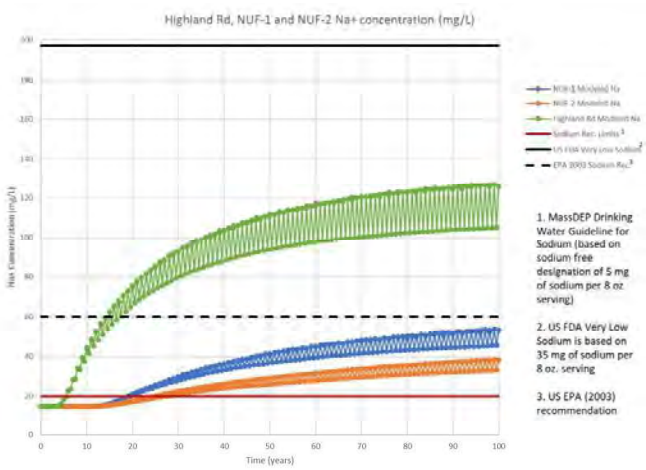
Highland Road and NUF Sodium Concentrations

NUF Current



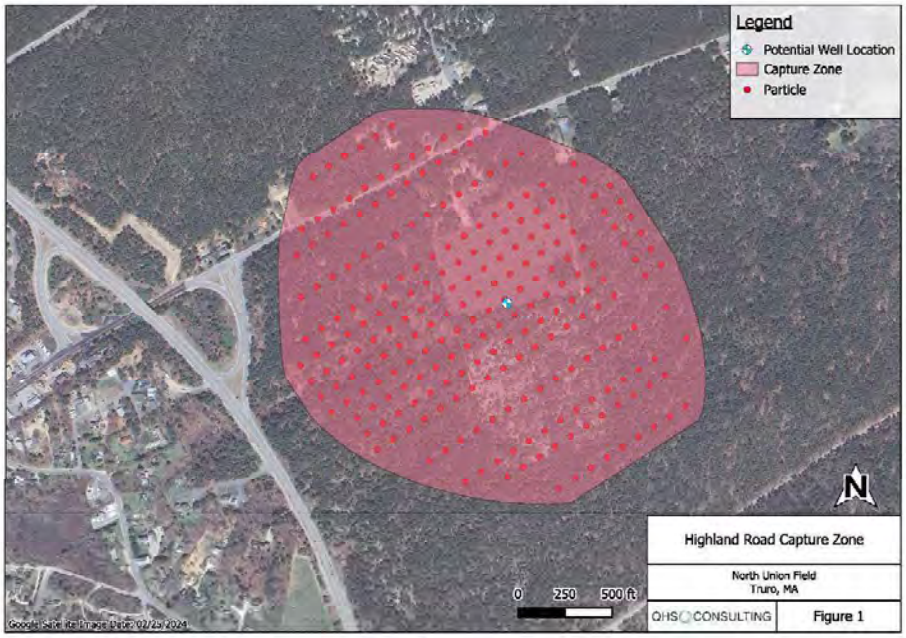
Sodium

Highland Road



Sodium

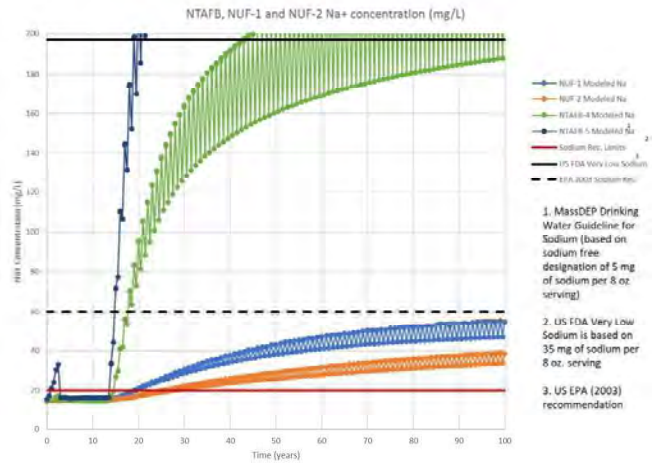
Area of Contribution – Highland Road



NTAFB Wells

- Owned by NPS CCNS
- Estimated safe yield of 0.57 MGD
- Historical Special Use Permit
- Would require agreement with NPS for use of wells
- No assessment of water quality impacts
- Potential Impacts to NUF Wellfield Wells
- Furthest east – potential saltwater upconing/
  lateral intrusion due to thinner freshwater lens and proximity to Atlantic Ocean
- NTAFB Well #5 closer to the coast than Well #4

Results – NTAFB Wells (same scale as other sites)



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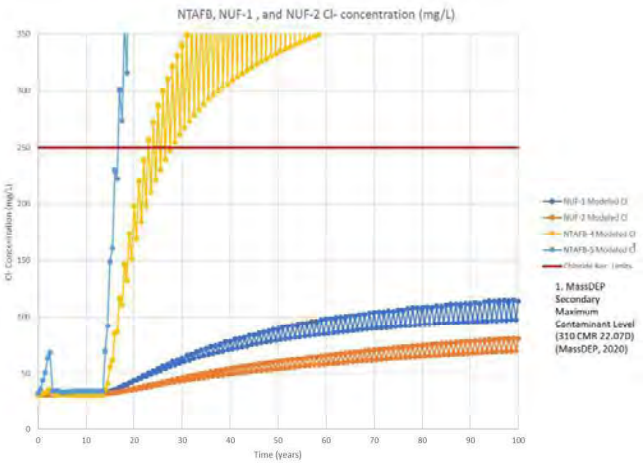
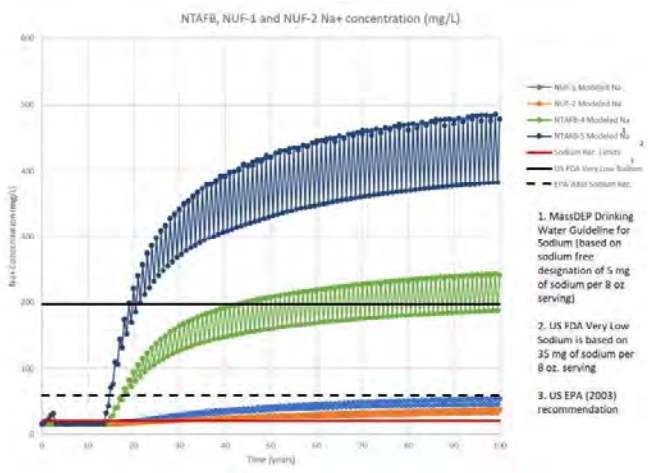
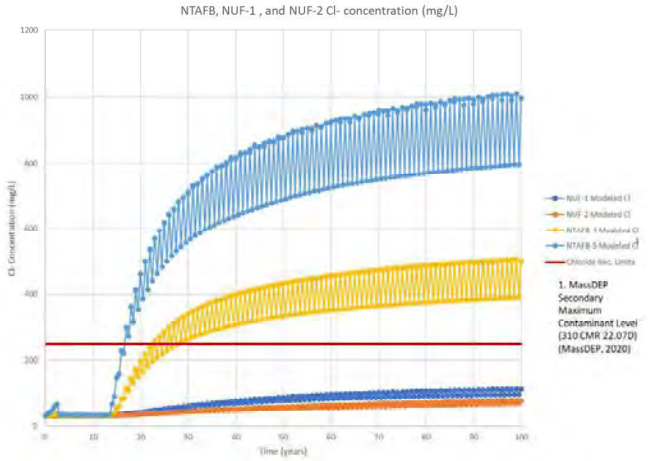


Chloride

Results – NTAFB Wells (Adjusted Scale)



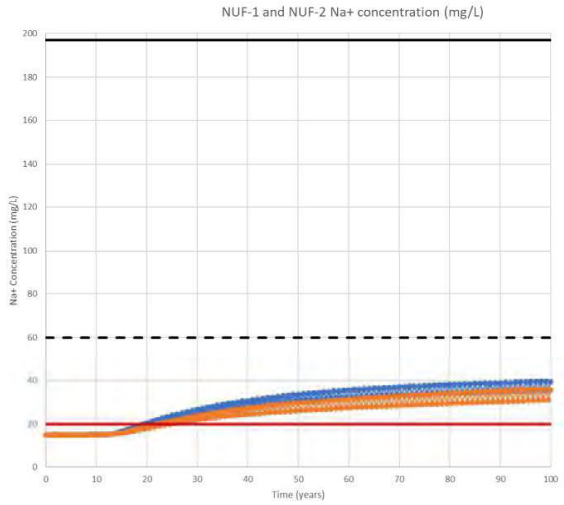
Sodium



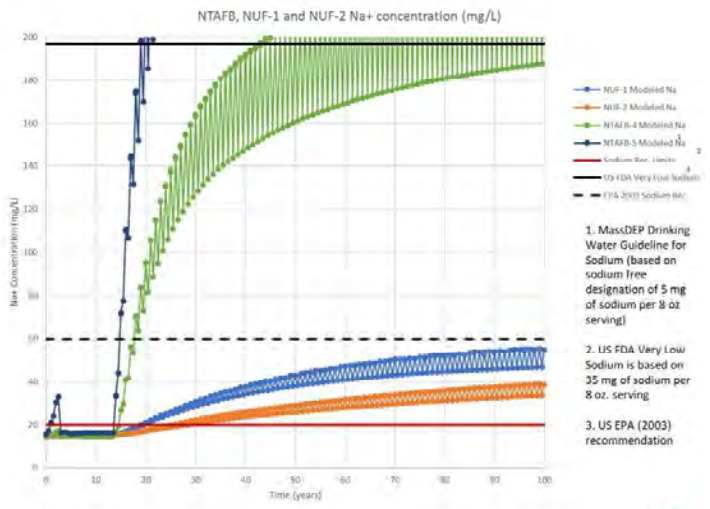
Chloride

NTAFB Wells and NUF Sodium Concentrations

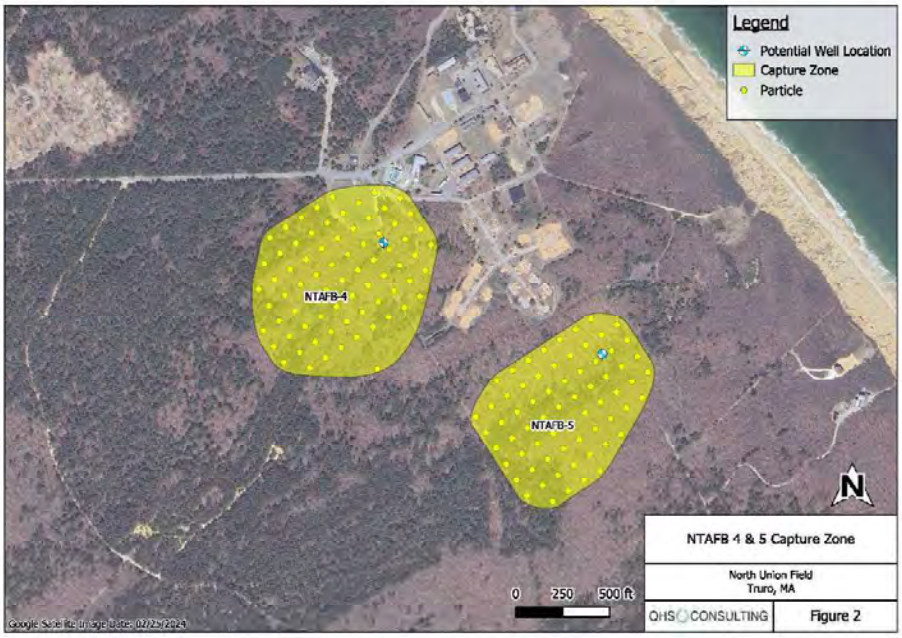
NUF Current



NTAFB Wells



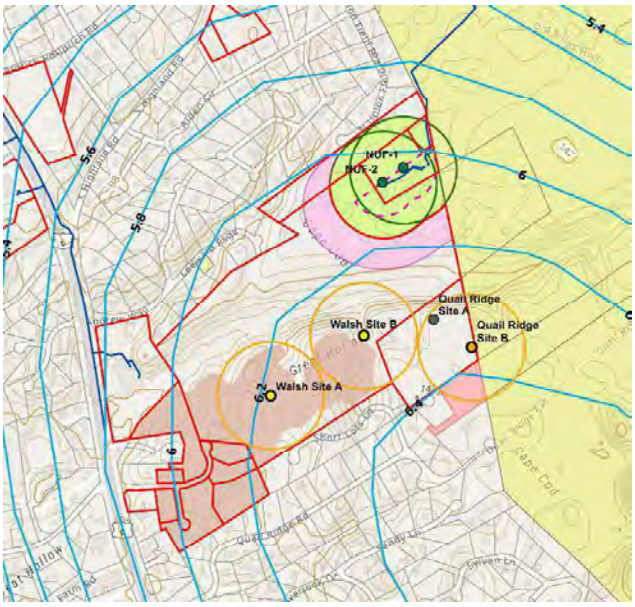
Area of Contribution – NTAFB Wells



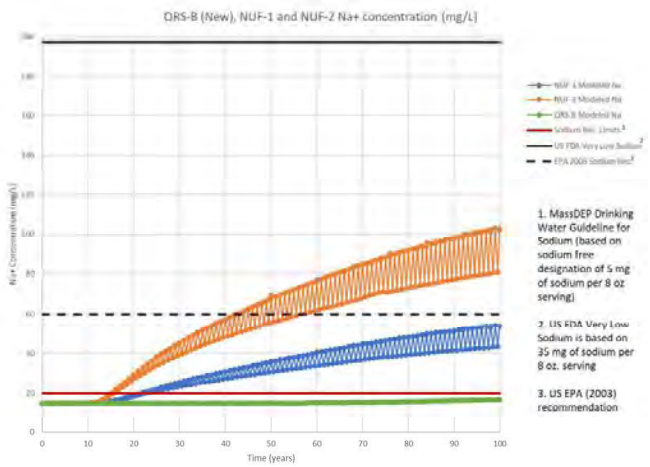
Model Results – Quail Ridge B, Walsh Site A, Long Nook Road, Site C-5, Prince Valley Road

Results – Quail Ridge B

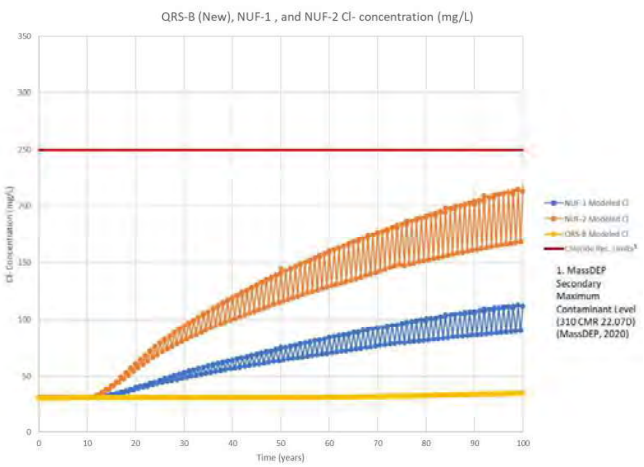
- Owned the by Town of Truro
- Requires acquisition of parcels to south (Ziller Path) for Zone I compliance
- Previously assessed – interference with NUF Wells and saltwater upconing at higher pumping rates
- Pumping this site at a lower pumping rate in combination with another source may be a viable alternative
- Pumping Rates:
  - Summer: 350,000 gpd
  - Winter: 200,000 gpd



Results – Quail Ridge B

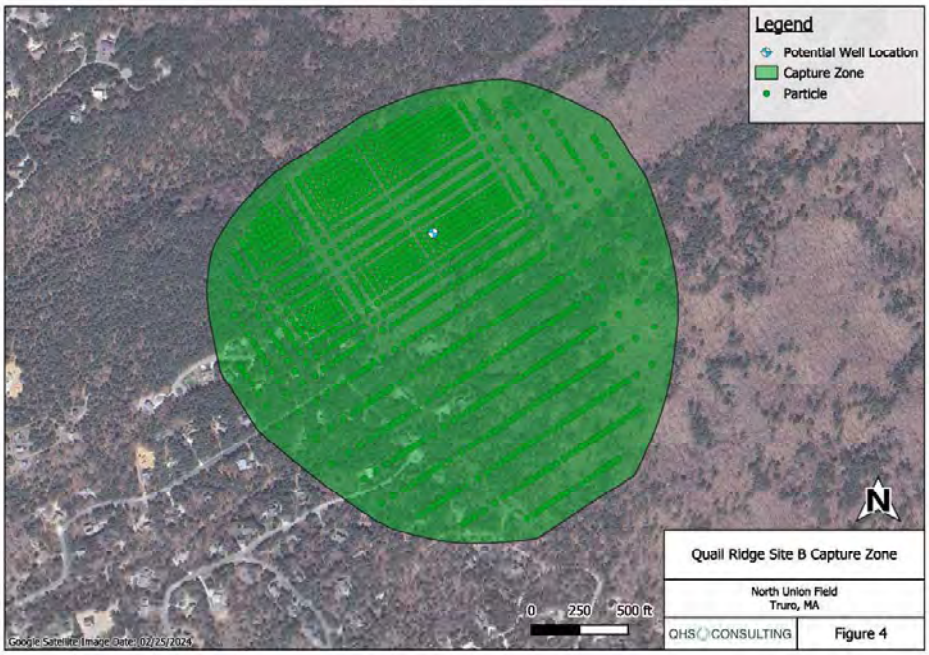


Sodium



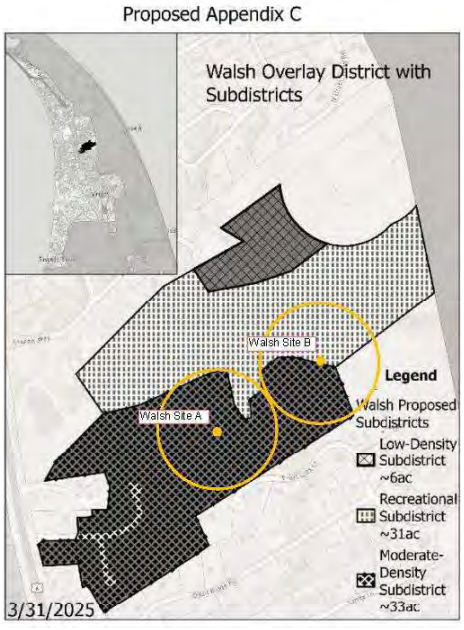
Chloride

Area of Contribution – Quail Ridge B



Walsh Site A

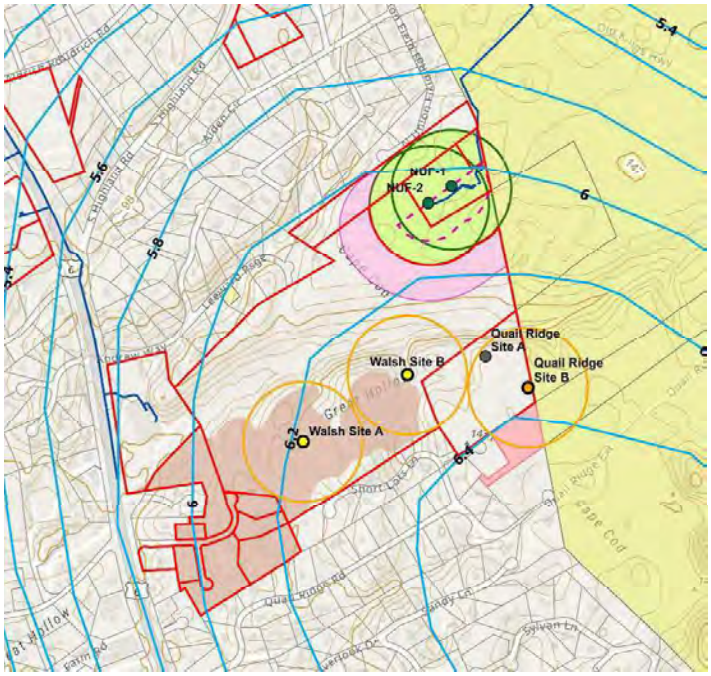
- Select board requested modeling of the Walsh Property
- Apex identified potential sites Walsh Site A/B
  - Location A is as far from NUF as possible on the west side of the Pamet Lens (1,800 feet southwest of NUF-2)
  - Location B is closer to NUF and outside of the proposed development area (1,100 feet southwest of NUF-2)
- Show the hypothetical preservation area on the Walsh Property for potential future replacement of the NUF wells (Zone I area)



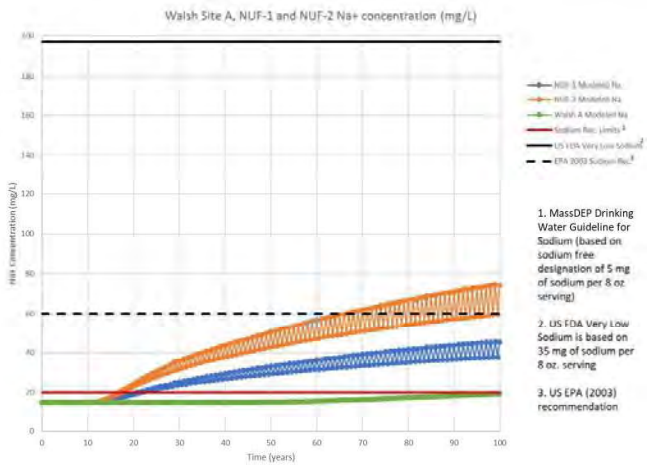
Walsh Zoning Overlay - Draft Hypothetical Sites

Results – Walsh Site A

- Location on the Walsh Property is higher on the Pamet Lens and on the Cape Cod Bay side of the lens, suggesting less impacts to NUF wellfield
- Pumping Rates:
  - Summer: 350,000 gpd
  - Winter: 200,000 gpd



Results – Walsh Site A



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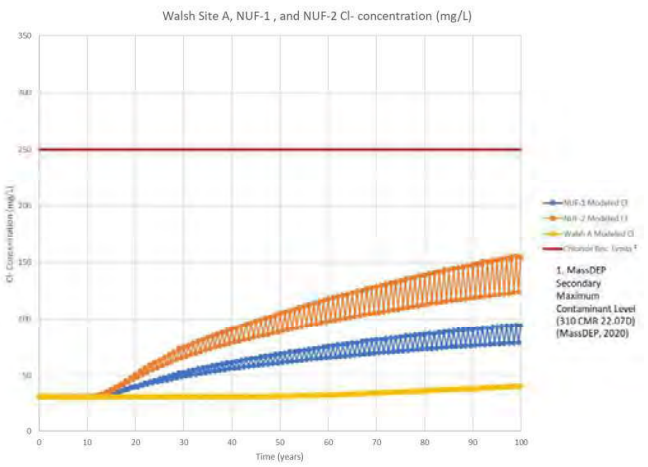
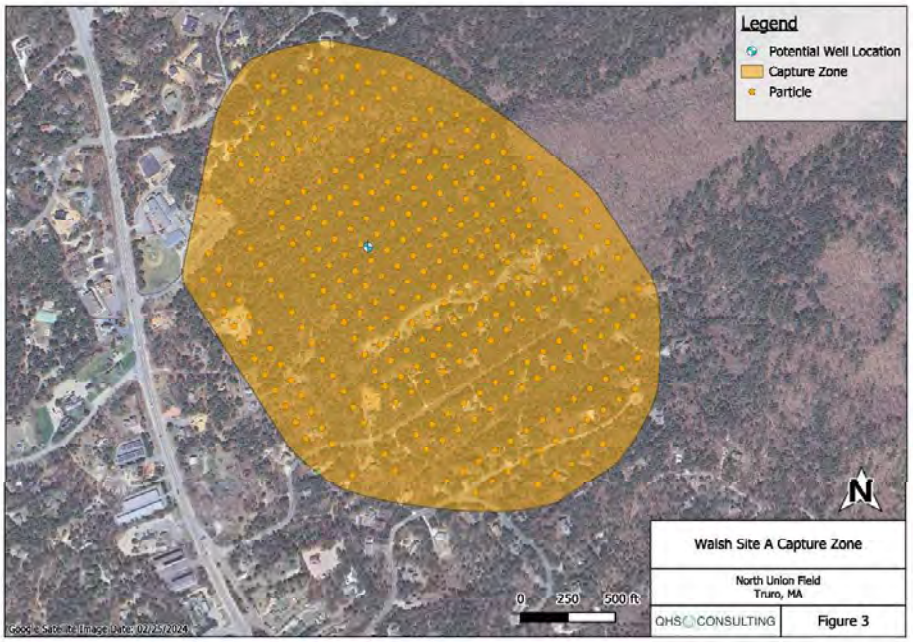
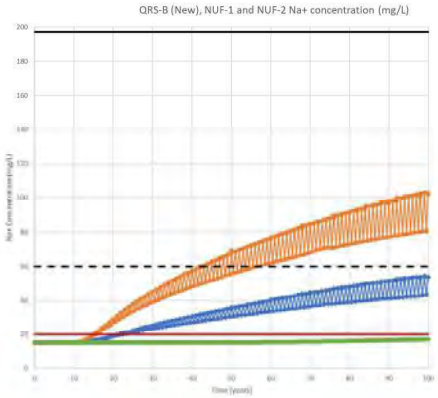


Chloride

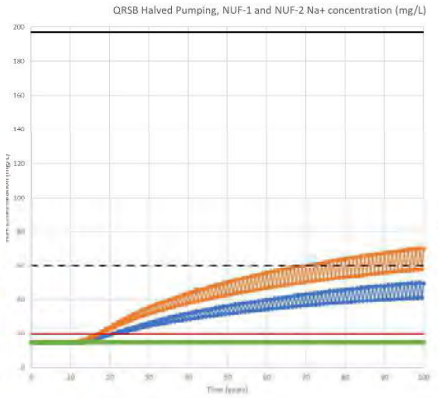
Area of Contribution – Walsh Site A



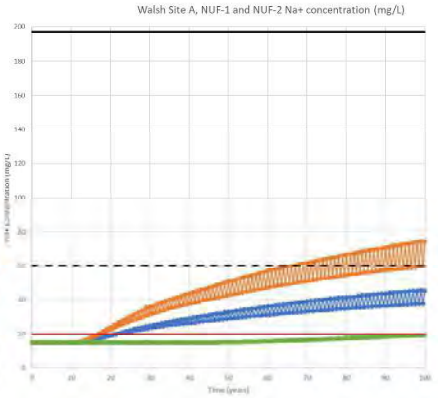
Comparison – Walsh Site A and Quail Ridge B – Sodium Concentrations



Quail Ridge B Pumping
350,000 gpd Summer
200,000 gpd Winter

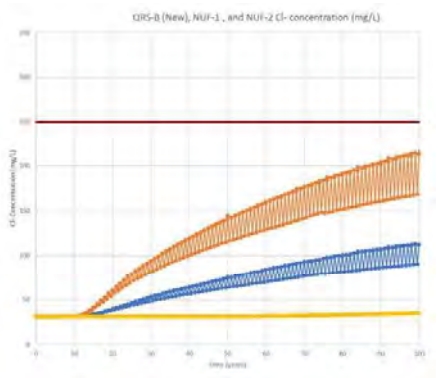


Quail Ridge B Pumping
175,000 gpd Summer
100,000 gpd Winter

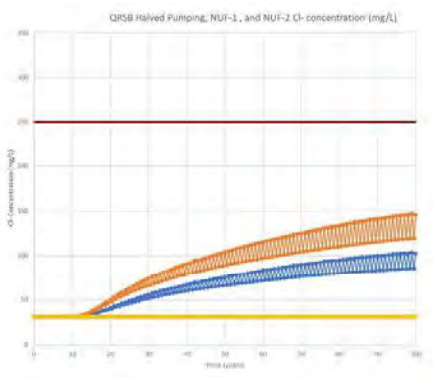


Walsh Site A Pumping
350,000 gpd Summer
200,000 gpd Winter

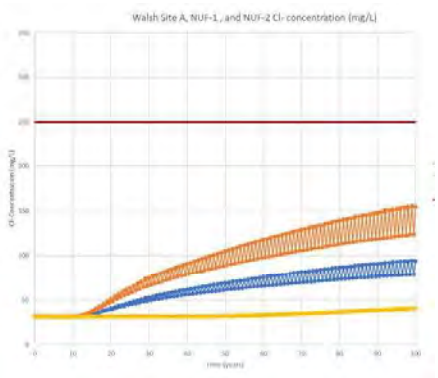
Comparison – Walsh Site A and Quail Ridge B – Chloride Concentrations



Quail Ridge B Pumping
350,000 gpd Summer
200,000 gpd Winter



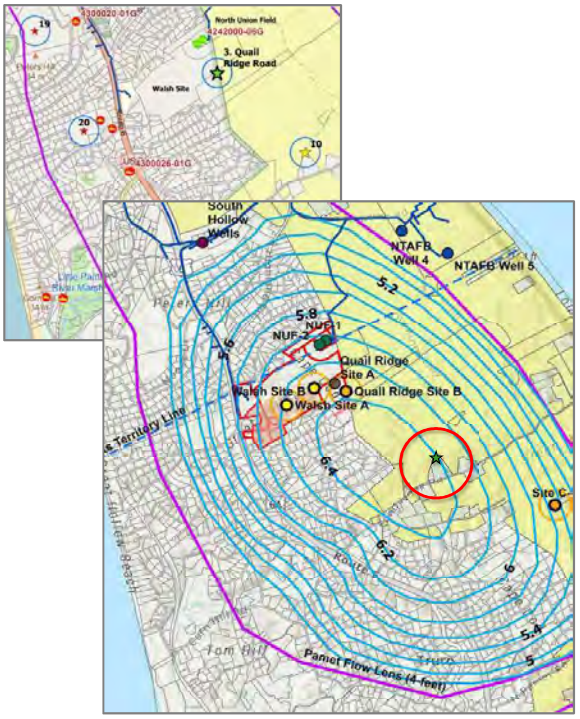
Quail Ridge B Pumping
175,000 gpd Summer
100,000 gpd Winter



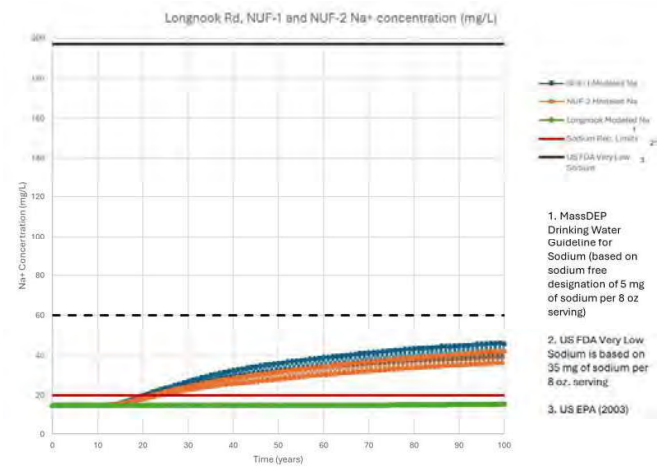
Walsh Site A Pumping
350,000 gpd Summer
200,000 gpd Winter

Long Nook Road Site

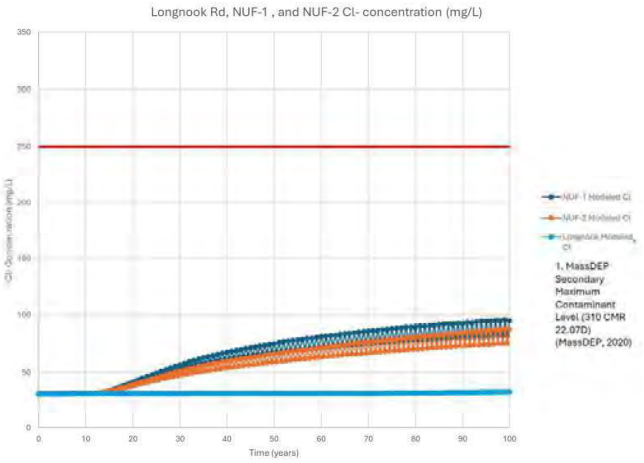
- Privately owned parcel. The northern part of the parcel appears undeveloped with a structure located on the southern part of the property close to Long Nook Road.
- The parcel is surrounded by National Seashore to the north.
- A well could be located greater than 400 feet from the structure on undeveloped land.
- There is a privately owned parcel to the southwest that would require ownership/easement for the undeveloped portion within the Zone I.
- Potential impacts to Pamet River, NUF, and Site C-5 need to be assessed.
- Previous studies by Apex/EP indicate Little Pamet River is underlain by peat and would have little impact from pumping at Long Nook Road Site but this would need to be confirmed with additional field assessment.
- Pumping Rates:
  - Summer: 350,000 gpd
  - Winter: 200,000 gpd



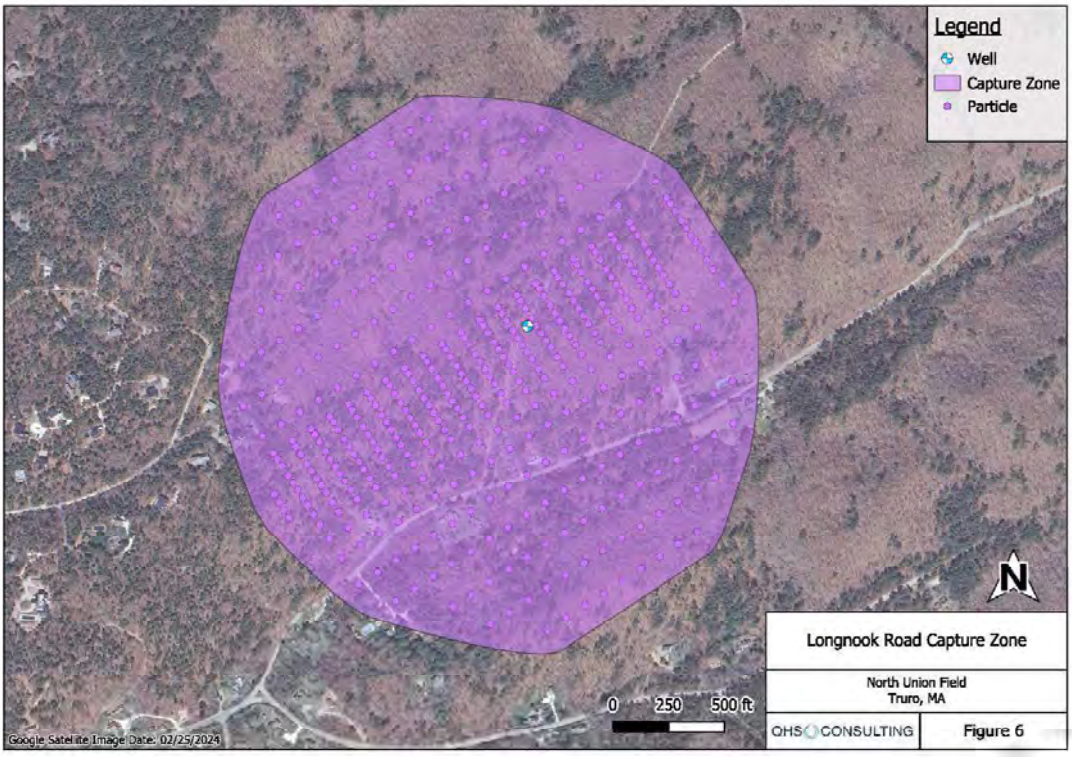
Results - Long Nook Road Site



Sodium



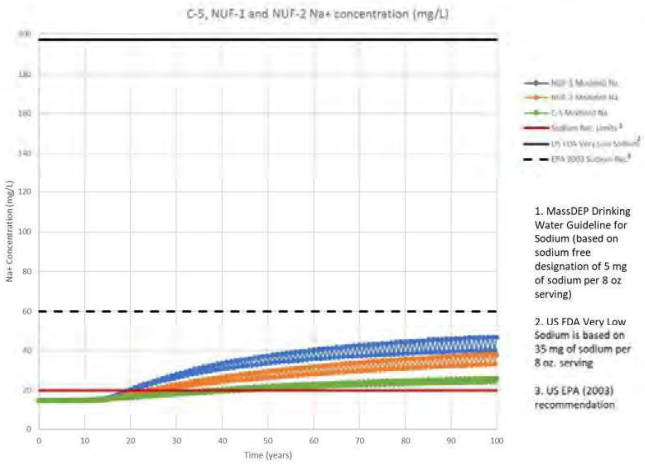
Chloride



Results – Site C-5

- Ownership Uncertain – Town-owned parcel (?) surrounded by National Seashore
- Drilling, testing, and preliminary modeling 2002-2004
- Modeling of pumping impacts from saltwater upconing/ intrusion indicates potential withdrawal of 450,000 gpd
- Approvable well yield likely limited by potential impacts to Pamet River
- Potential well yield after Pamet River Restoration needs to be modeled
- Pumping Rates:
  - Summer: 350,000 gpd
  - Winter: 200,000 gpd

Results – C5 Site



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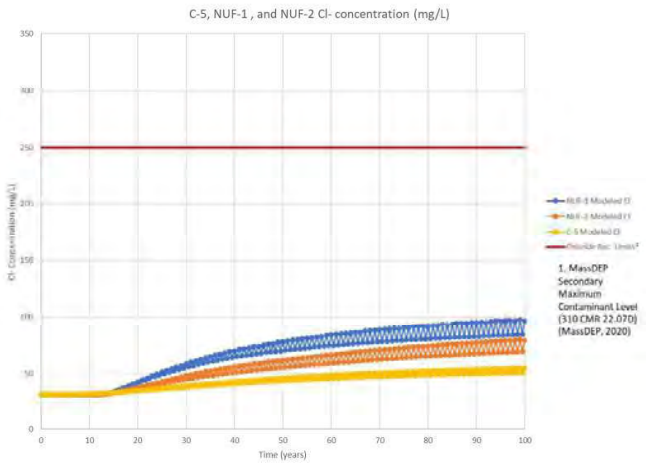
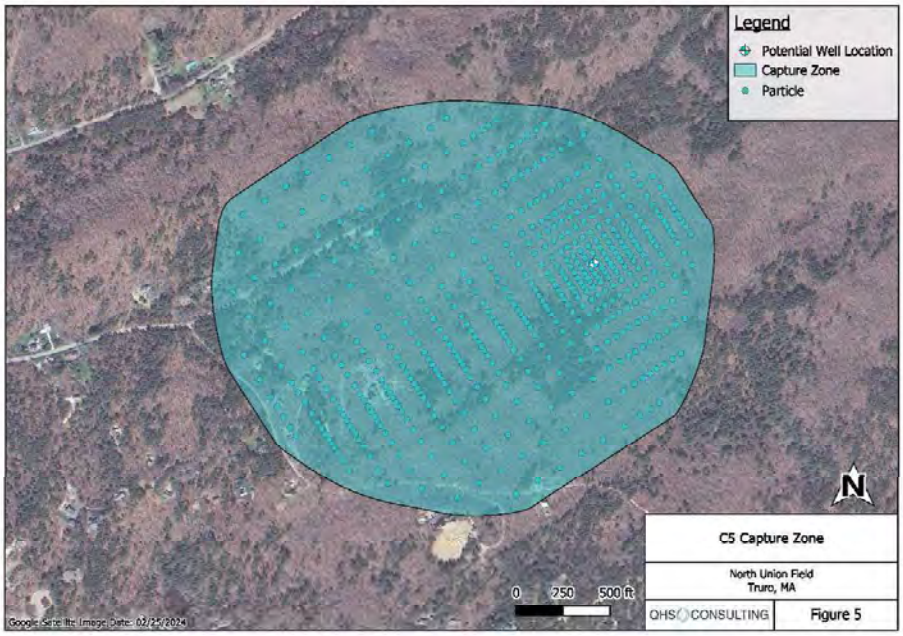
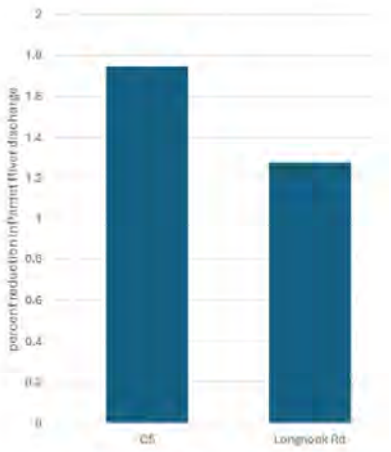


Chloride

Area of Contribution – Site C-5



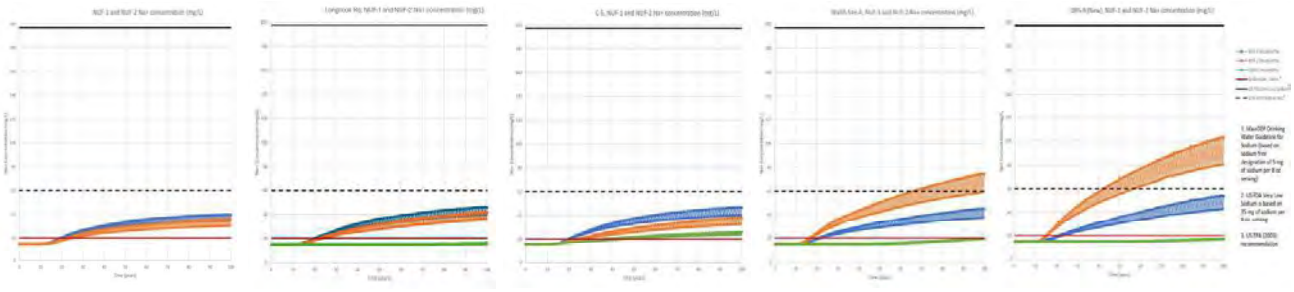
Potential Reductions to Modeled Pamet River Discharge – Site C-5 and Long Nook Road



Model Results – Comparison of Drawdown and Sodium and Chloride Concentrations NUF, Long Nook Road, Site C-5, Walsh Site A, and Quail Ridge B

Modeled Sodium Concentrations – Comparison

NUF | Long Nook Road | Site C-5 | Walsh Site A | Quail Ridge B



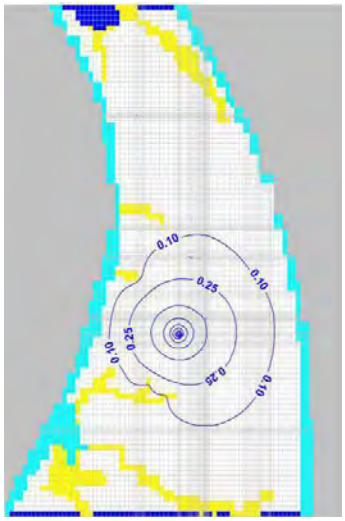
NUF Pumping
428,000 gpd Summer
186,000 gpd Winter

Other Individual Sites
350,000 gpd Summer
200,000 gpd Winter

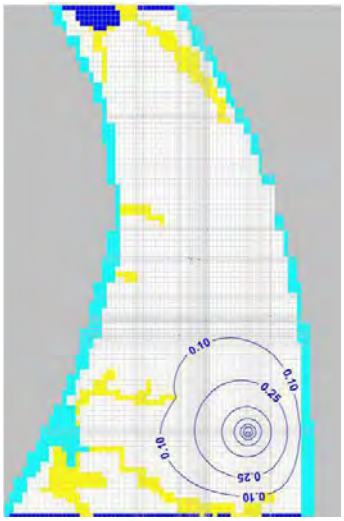
Modeled Drawdown – Comparison Pumping

350,000 gpd Summer
200,000 gpd Winter

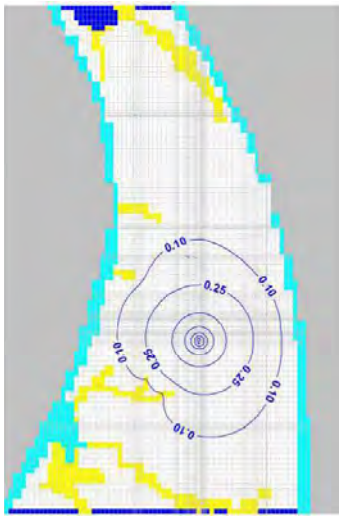
Walsh Site A



C-5

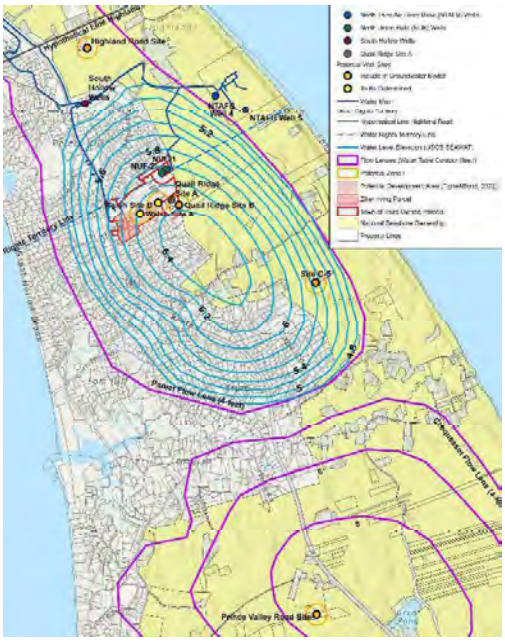


Quail Ridge B



Results – Prince Valley Road Site

- Located within the Chequesset Flow Lens
- DELAYED – incorporating Chequesset Flow Lens and model calibration
- Owned by the Town of Truro
- Undeveloped land surrounded by the National Seashore
- Further from the coast (lower concern for saltwater intrusion/ up-coning)
- Spreads out the withdrawals and promotes the multi straw approach
- Located far from existing water infrastructure (approx. 3.7 miles)
- Potential concerns to assess:
  - Potential pumping impacts to Pamet River
  - Potential pumping Impacts to Great Pond, Snow Pond and Ryder Pond
  - Potential PFAS water quality impacts from Closed Landfill



3 Cost Estimates

Cost Estimate Summary		
Walsh A	$	6,180,000
Quail Ridge B	$	6,480,000
Long Nook Road	$	8,680,000
C-5	$	9,030,000
Prince Valley	$	13,430,000

Costs Include

- Wells and Well Pump Station, Production Wells, and Appurtenant Work
- 8-inch Ductile-Iron Water Main, Class 50 Pipe (Local Roads)
- 8-inch Ductile-Iron Water Main, Class 50 Pipe (Route 6)
- Police Detail for Installation on Route 6 (Two Officers)
- Electrical Service

Costs do NOT include

- Land Purchase
- Extensive Treatment

4 Site Rankings and Conclusions

Site Rankings

Potential Water Supply Site Ranking

Site Ranking Evaluation - Provincetown Truro Watershed Study

Evaluation Criteria	Potential Water Supply Sites in Truro				
	Walsh Site A	Long Nook Road	Site C-5	Prince Valley Road (Preliminary)	Quail Ridge B
Saltwater Upconing (1)	3	3	3	3	3
Potential Withdrawal Capacity	2	3	2	3	1
Impacts to Existing Sources (NUF)	2	3	3	3	1
Sensitive Environmental Receptors	3	2	2	2	3
Resiliency /Sea Level Rise (Preliminary)	3	3	2	3	3
Proximity to System/Cost to Develop	3	2	2	1	3
Potential for Contamination Sources	3	3	3	2	3
Site Ranking	**19**	**19**	**17**	**17**	**17**
Land Ownership (Owned by Truro)	3	1	2	3	1
Site Ranking (including Land Ownership)	**22**	**20**	**19**	**20**	**18**

Notes: Ranking Criteria are all weighted equally.
(1) Assumes pumping at 350,000 gpd Summer/200,000 gpd Winter

Conclusions

Conclusions

1. A detailed desktop study was conducted to identify parcels that are large enough to support a MassDEP required 400-foot Zone I. This study included both Town-owned and private parcels.
2. A total of 33 locations were identified that could support ownership or control of the MassDEP required 400-foot Zone I.
3. Potential water supply sites selected for groundwater modeling include 6 within the Pamet Lens aquifer and 1 within the Chequesset Lens aquifer.
4. Initial modeling show Highland Road Site and NTAFB Site are not potentially viable PWS sites due to limited freshwater lens resulting in saltwater upconing or lateral intrusion. NTAFB Site may be used seasonally or for emergency uses but additional modeling would be required to assess pumping impacts on water quality.

Conclusions (continued)

5. Three potentially viable PWS sites identified within Pamet Lens – Walsh Site A/Quail Ridge B, Long Nook Road, and Site C-5. Walsh Site A preferable to Quail Ridge B with less impacts to NUF water quality.
6. Evaluations conducted in 2000- 2004 identified two potentially viable PWS sites – C-5 and NUF (adjacent to Walsh Property). NUF was permitted as a new PWS source in 2011.
7. Two new source desktop studies within the Pamet Lens identified the same two parcels for PWS development. These results show that although there are a lot of potential PWS sites within the Pamet Lens, potentially viable new water supply sources are extremely limited, and the two sites should be preserved for public water supply development.
8. To best preserve the Quail Ridge B site or Walsh Property Site A, wastewater from any development on the Walsh Property should be directed to the west of Route 6.
9. Due to the limited availability of potentially viable PWS sites, identified potential new sources and exiting water supply sources need to be protected from future impacts.

Next Steps – Determine Additional Modeling Runs

Potential Additional Modeling Scenarios

1. No additional modeling with Highland Road.
2. Modify model to include only supplemental summer use of NTAFB Wells?
3. Incorporation of Prince Valley Road – need initial model results.
4. Model Run 1: Select Sites to be included (Prince Valley Road, Site C-5, Long Nook Road, Walsh Site A, Quail Ridge B). Current Conditions or with Pamet River Restoration?
5. Model Run 2: To be Determined based on Run 1.
6. Run model to evaluate potential impacts to public water supply wells associated with future Sea Level Rise
   - Two Model Scenarios with 1, 3, and 6 feet of sea level rise
   - One current conditions and one with Pamet River Restoration?
   - Sites to include would depend on results of combined pumping Model Runs 1 and 2 (above).

5 Discussion

12-10-2025

Monthly Meeting

Drinking Water and Wastewater

Regional Water Supply and Watershed Management Study – 12/10/2025

APEX

Agenda

1. Groundwater Modeling
2. Water Demands
3. Discussion

1 Groundwater Modeling

APEX

Groundwater Model – Scope

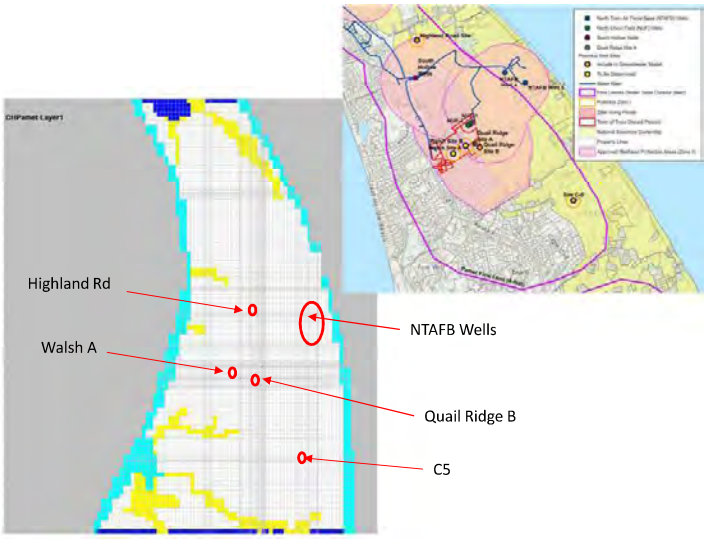
1. Update Pamet Lens Model, Add Chequesset Lens, and Incorporate Pamet River Restoration
2. Incorporate 6 proposed potential public water supply sources.
3. Model each source separately to evaluate potential salinity impacts
4. Conduct up to two additional modeling scenarios based on individual well results.
5. Run model to evaluate potential impacts to public water supply wells associated with future Sea Level Rise – (1, 3, and 6 feet of sea level rise)

Groundwater Model – Overview

1. Modifications to Existing Model
2. Initial Modeling Analyses
3. Modeled Salinity Impacts – Potential Well Locations and NUF Wells 1 and 2
4. Potential Reductions in Discharge to Pamet River
5. Zone of Contribution Map – Placed a large area of particles at the water table, run model forward, and identify which particles are captured by the well of interest.

Modifications to Existing Model

- Potential Public Water Supply Sites were incorporated into the existing Pamet Lens Groundwater model. Potential locations include:
  - Walsh Site A
  - Highland Road
  - Quail Ridge Site B
  - C5 Site (included in original model)
  - NTAFB Wells (included in original model)
  - Prince Valley Road (delayed due to USGS/Government shutdown)
- The model grid in the vicinity of both the potential new wells (and existing wells) was refined to better represent these features



Initial Modeling Analyses

Table 1. Seasonal Pumping Rates – Model Scenario 1

Source	Pumpage (gpd)	
	Winter Rate (Nov – Apr)	Summer Rate (May – Oct)
New Source	200,000	350,000
NTAFB	198,018	296,367
NUF-1	64,422	131,141
NUF-2	121,162	238,165
South Hollow	220,789	548,904
Knowles Crossing	68,689	139,090
Total Withdrawal	873,080	1,703,667

*NTAFB wells were included in all model scenarios using measured average rates, as well as an individual scenario with increased rates used for other potential well locations

- The Pamet Lens Model simulates seasonal pumping from PWS wells over a 100-year period (2012-2112)
  - Summer Months: May through October
  - Winter Months: November through April
- The model was updated to incorporate average pumping rates for existing water supply wells (based on pumping data from the last 5 years)
- Separate runs were performed for each potential well location, with rates for each set at
  - 350,000 gpd for summer
  - 200,000 gpd for winter
- For wells in closer proximity to the Pamet River, the decrease in modeled discharge to the river as a result of well pumping was also evaluated

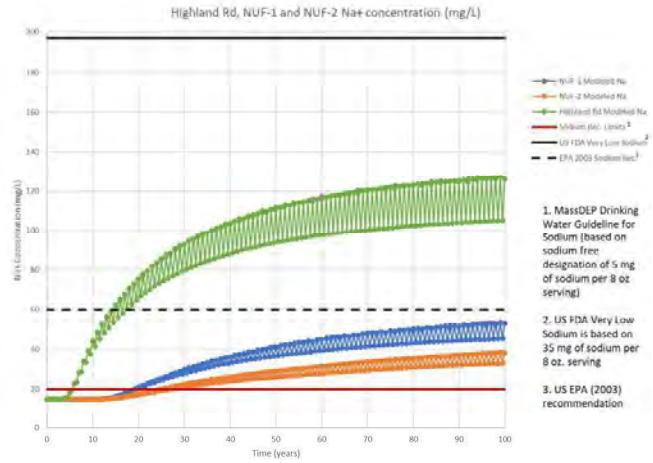
Model Results

Model Results – Highland Road Site and NTAFB Wells

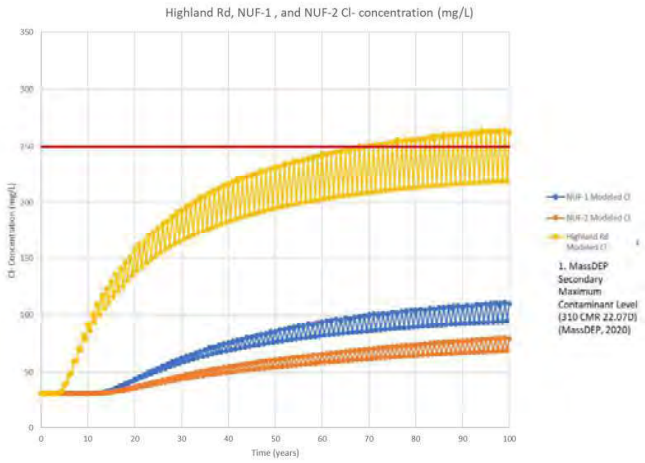
Highland Road Site

- Potential Impacts to South Hollow Wellfield Wells
- Furthest north – Potential saltwater upconing/ intrusion due to thinner freshwater lens

Results – Highland Road



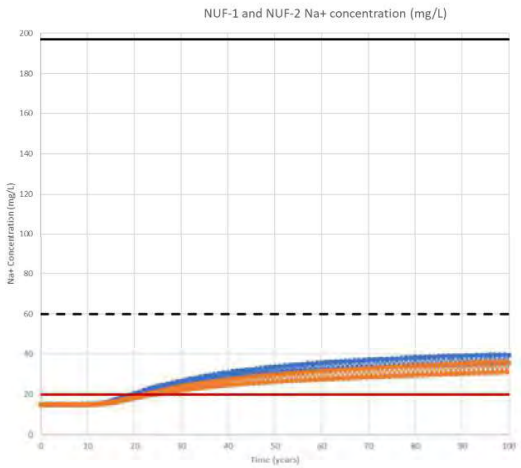
Sodium



Chloride

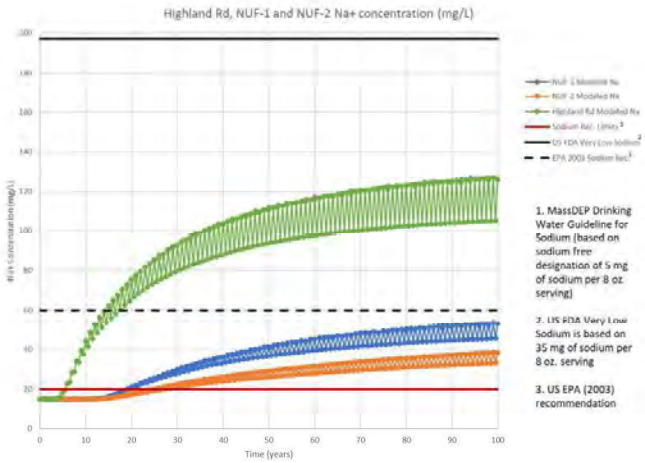
Highland Road and NUF Sodium Concentrations

NUF Current



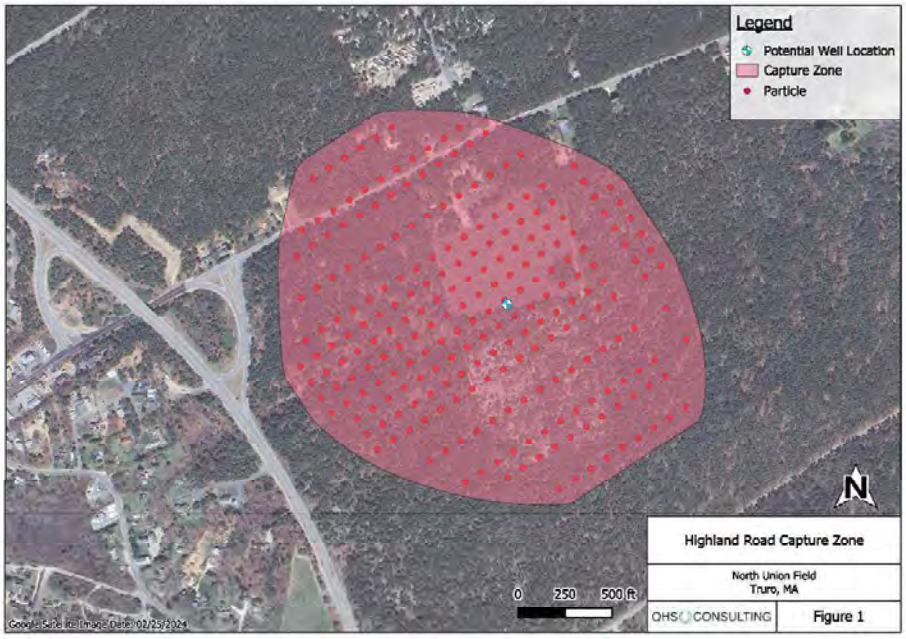
Sodium

Highland Road



Chloride

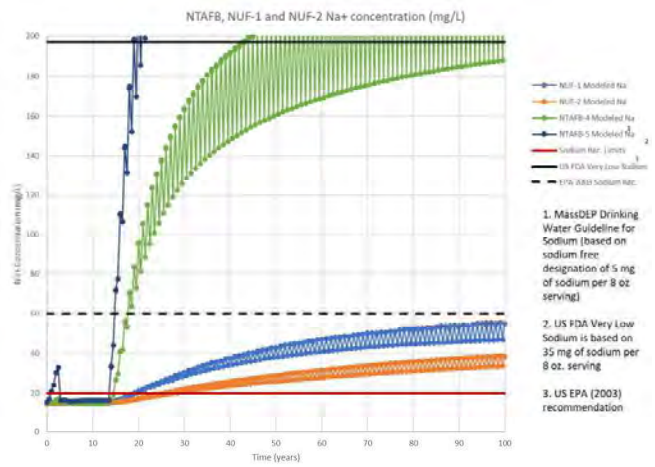
Area of Contribution – Highland Road



NTAFB Wells

- Historic average summer pumping 296,367 gpd
- No assessment of water quality impacts
- Potential Impacts to NUF Wellfield Wells
- Furthest east – potential saltwater upconing/ intrusion due to thinner freshwater lens and proximity to Atlantic Ocean
- NTAFB Well #5 closer to the coast than Well #4

Results – NTAFB Wells (same scale as other sites)



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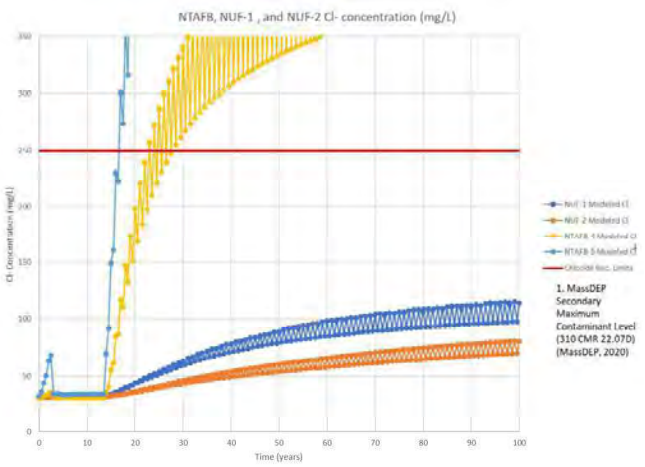
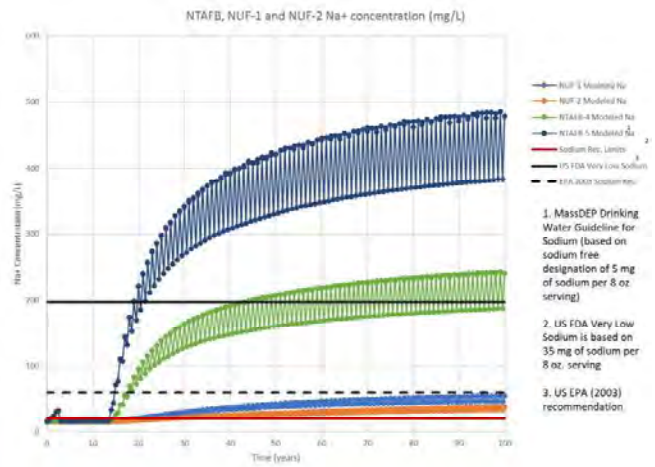
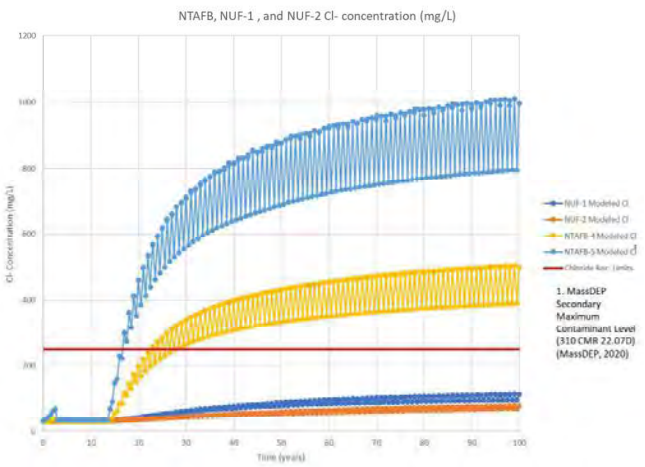


Chloride

Results – NTAFB Wells (Adjusted Scale)



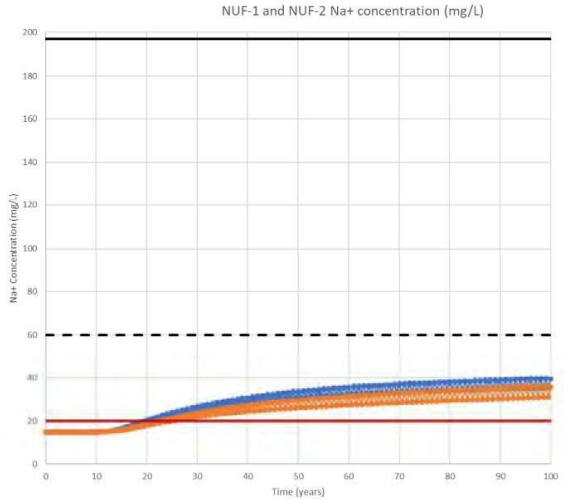
Sodium



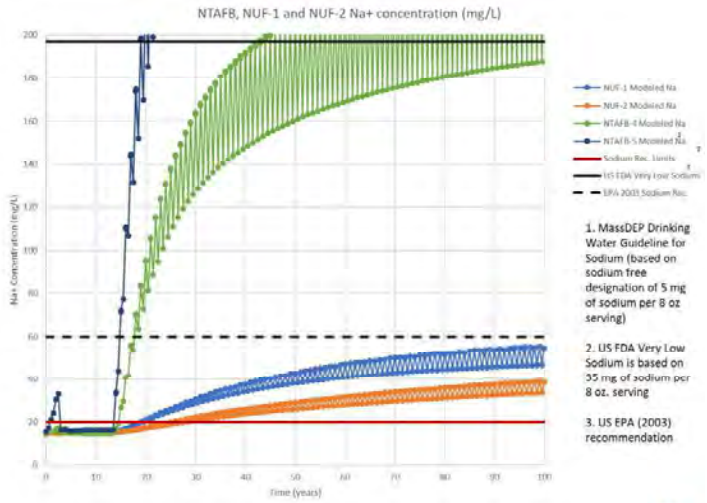
Chloride

NTAFB Wells and NUF Sodium Concentrations

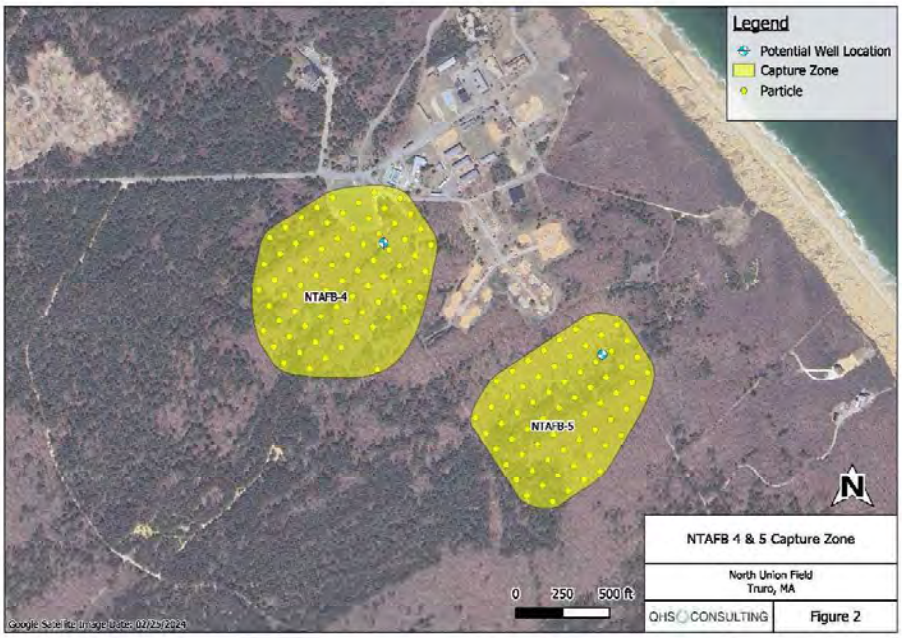
NUF Current



NTAFB Wells



Area of Contribution – NTAFB Wells



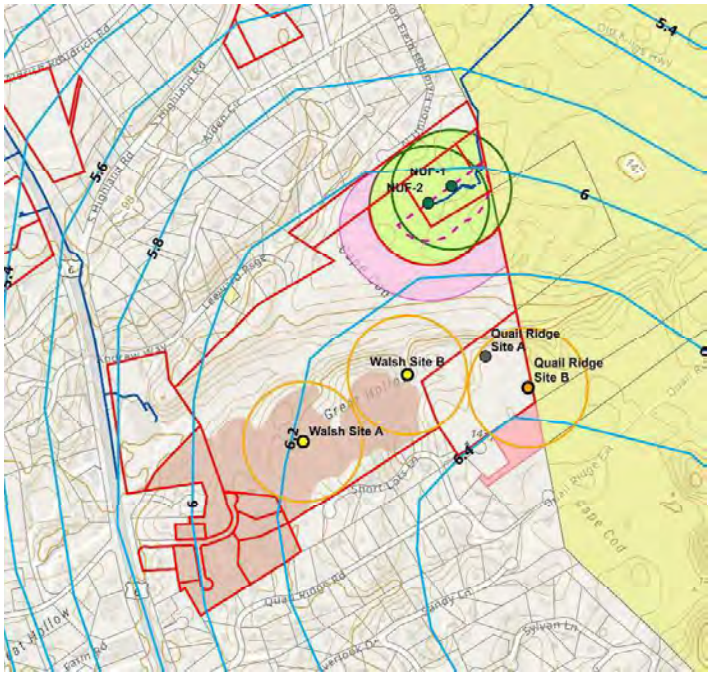
Model Results – Prince Valley Road Site Chequesset Lens

Prince Valley Road Site

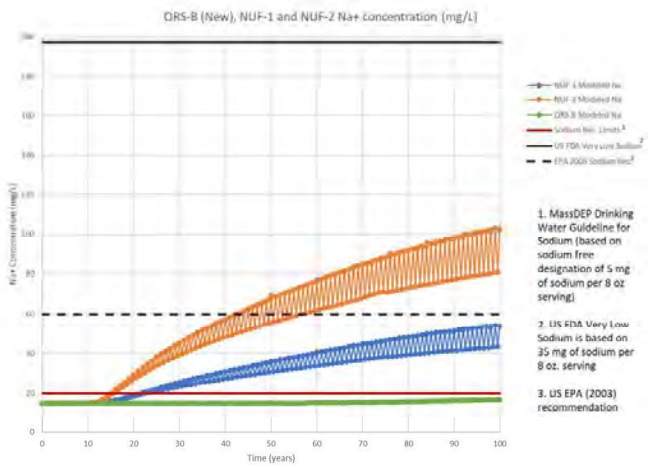
- Incorporate Chequesset Lens SEAWAT Model
- DELAYED due to USGS/Government Shutdown
- Received model and are modifying model for transient Prince Valley Road analyses.
- Potential concerns to assess:
  - Potential pumping impacts to Pamet River
  - Potential pumping Impacts to Great Pond, Snow Pond and Ryder Pond
  - Potential PFAS water quality impacts from Closed Landfill

Quail Ridge B

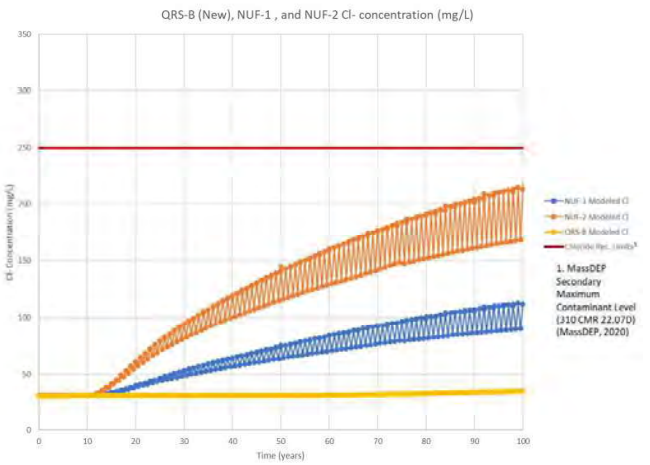
- Requires acquisition of parcels to south (Ziller Path) for Zone I compliance
- Pumping Rates:
  - Winter: 200,000 gpd
  - Summer: 350,000 gpd



Results – Quail Ridge B

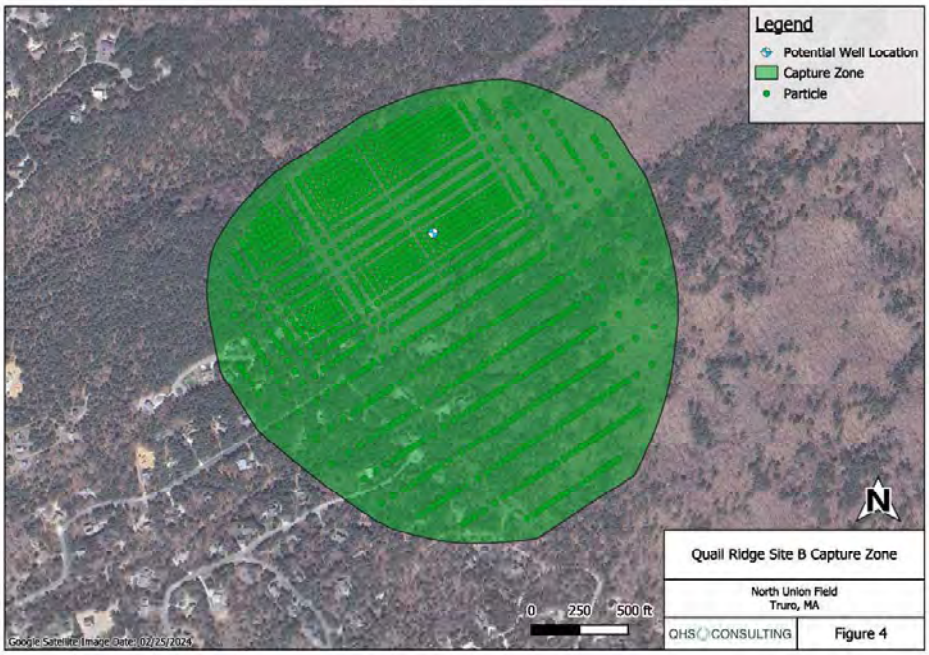


Sodium



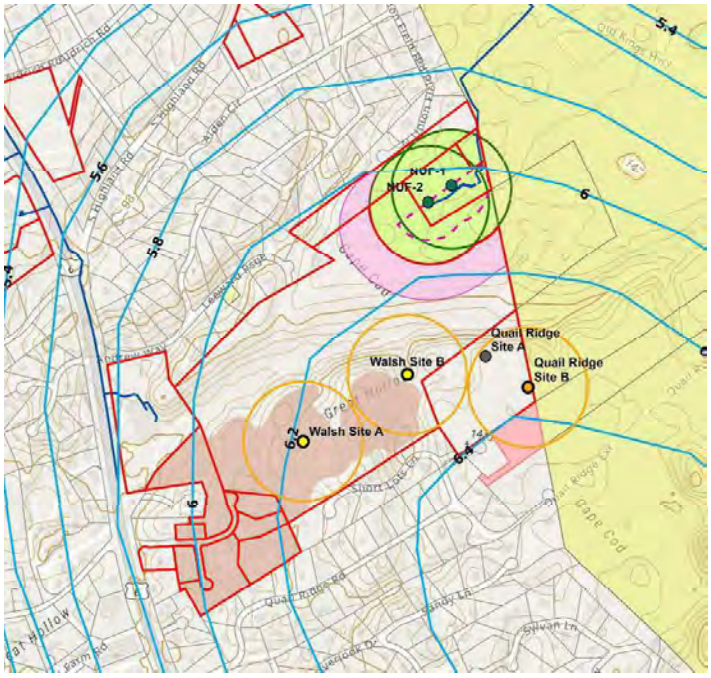
Chloride

Area of Contribution – Quail Ridge B

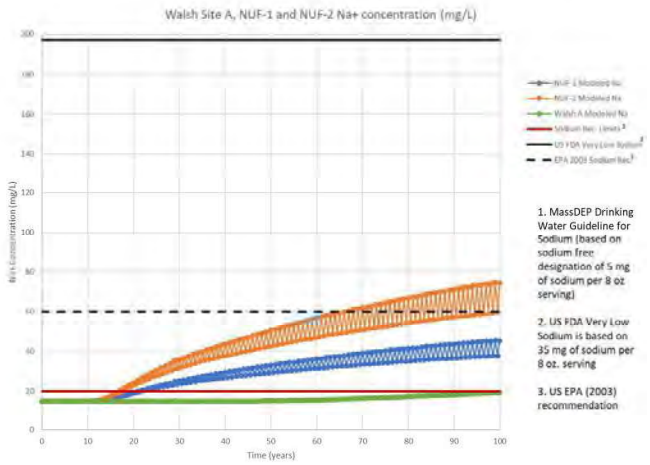


Walsh Site A

- Location on the Walsh Property is higher on the Pamet Lens and on the Cape Cod Bay side of the lens, suggesting less impacts to NUF wellfield
- Pumping Rates:
  - Winter: 200,000 gpd
  - Summer: 350,000 gpd



Results – Walsh Site A



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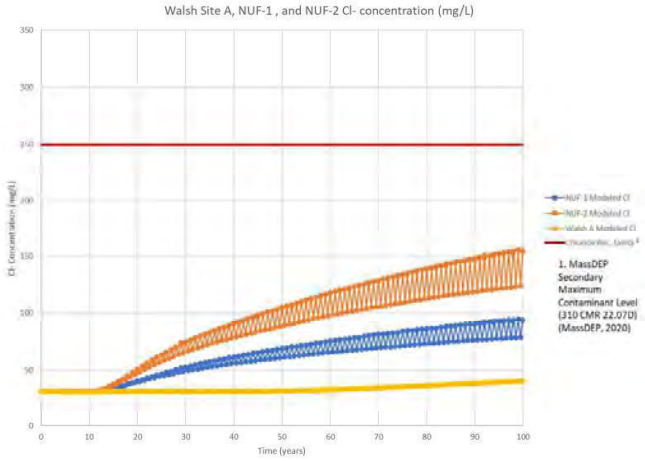
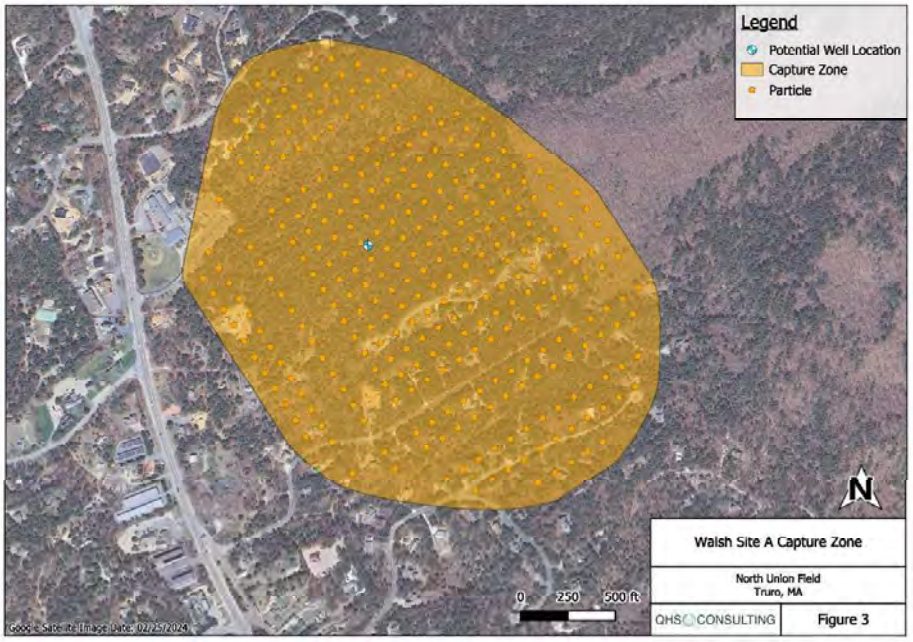
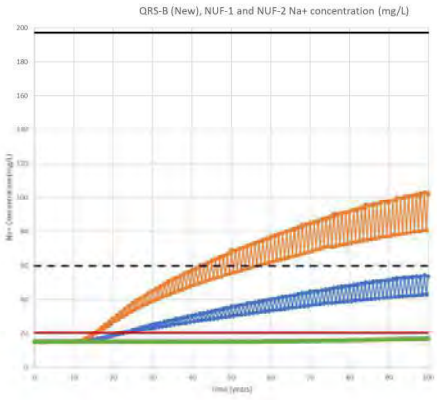


Chloride

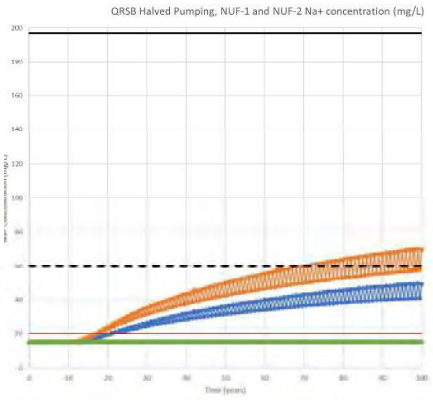
Area of Contribution – Walsh Site A



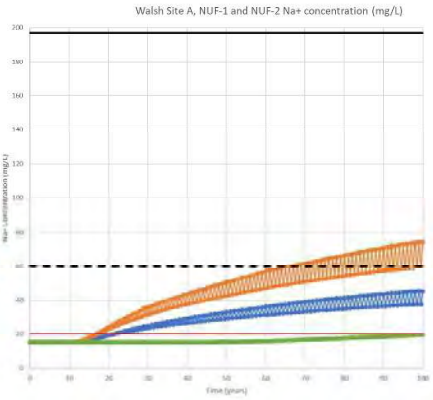
Comparison – Walsh Site A with Quail Ridge B (Reduced Pumping – 50%) - Sodium



Quail Ridge B Pumping
350,000 gpd Summer
200,000 gpd Winter

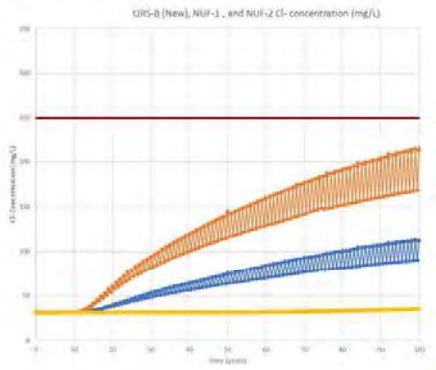


Quail Ridge B Pumping
175,000 gpd Summer
100,000 gpd Winter

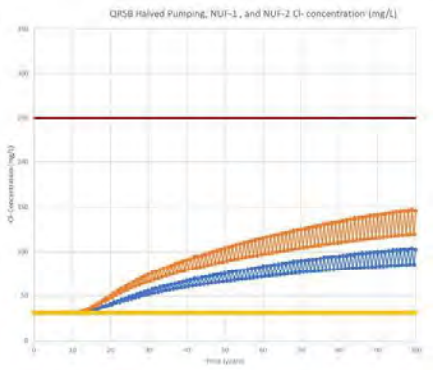


Walsh Site A Pumping
350,000 gpd Summer
200,000 gpd Winter

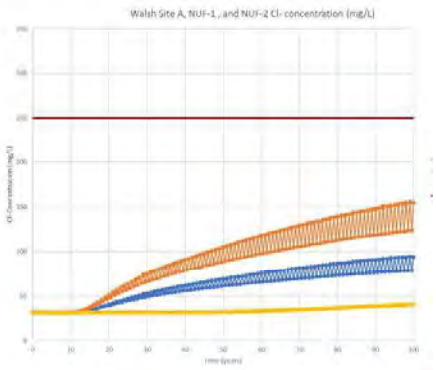
Comparison – Walsh Site A with Quail Ridge B (Reduced Pumping – 50%) - Chloride



Quail Ridge B Pumping
350,000 gpd Summer
200,000 gpd Winter



Quail Ridge B Pumping
175,000 gpd Summer
100,000 gpd Winter

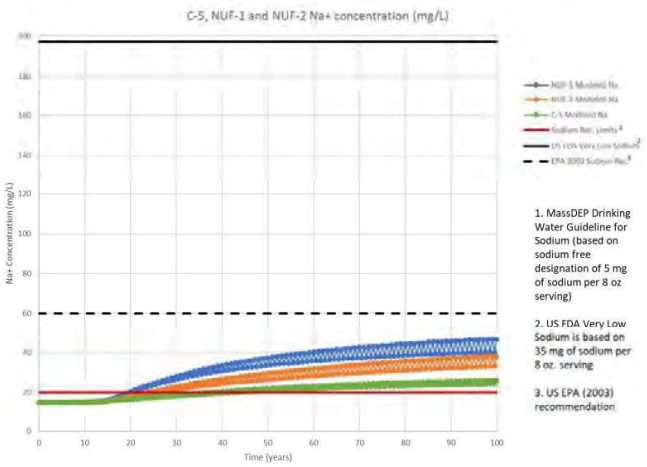


Walsh Site A Pumping
350,000 gpd Summer
200,000 gpd Winter

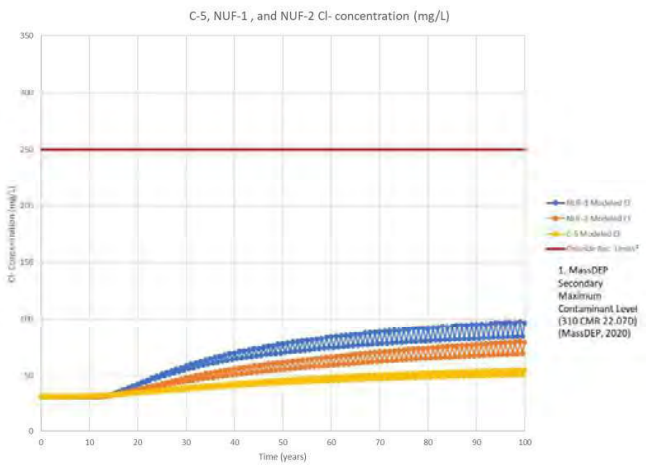
Results – Site C-5

- Potential saltwater upconing/intrusion due to thinner freshwater lens
- Potential pumping impacts to Pamet River
- Preliminary modeling 2002-2004 of pumping impacts from saltwater upconing/intrusion indicates potential withdrawal of 450,000 gpd
- Pumping Rates:
  - Winter: 200,000 gpd
  - Summer: 350,000 gpd

Results – C5 Site

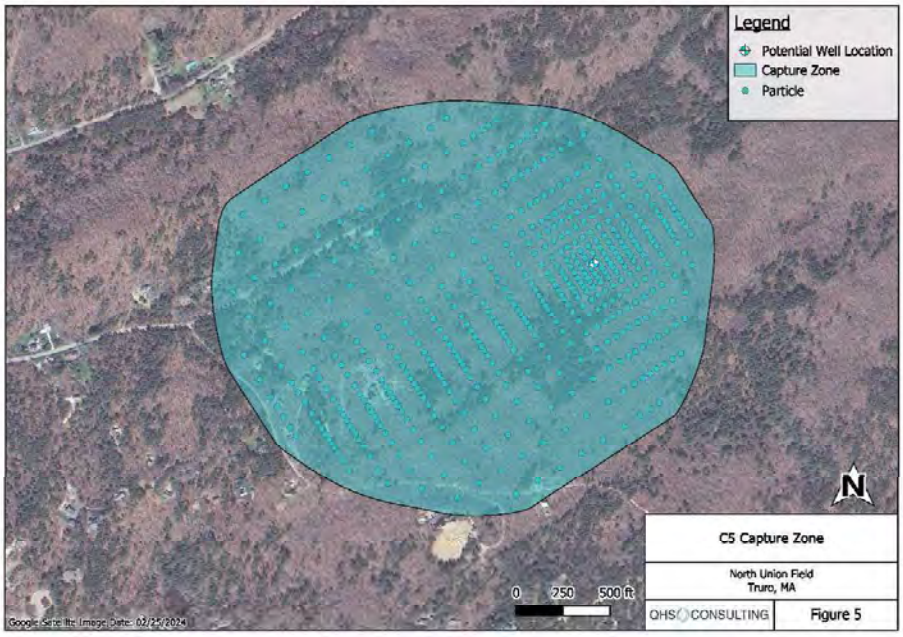


Sodium

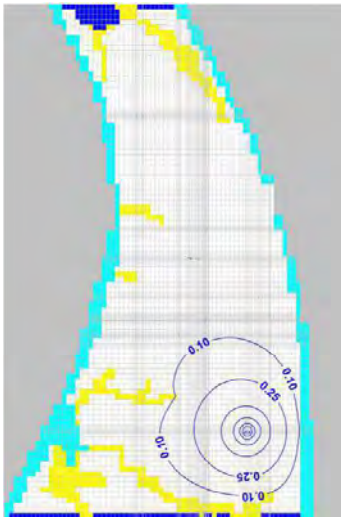


Chloride

Area of Contribution – Site C-5



Site C-5 Modeled Potential Impacts to Pamet River

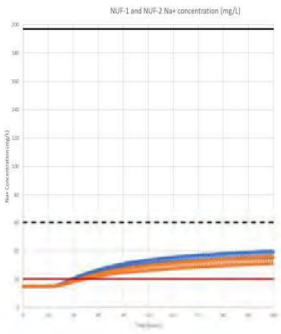


Potential Reductions to Modeled Pamet River Discharge ~1.75 percent

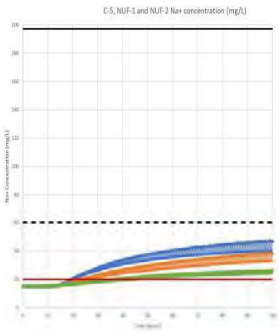
Model Results – Comparison of Drawdown Site C-5, Walsh Site A, and Quail Ridge B

Modeled Sodium Concentrations – Comparison

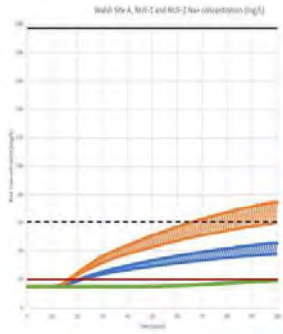
NUF



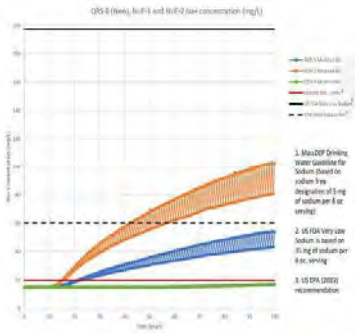
Site C-5



Walsh Site A

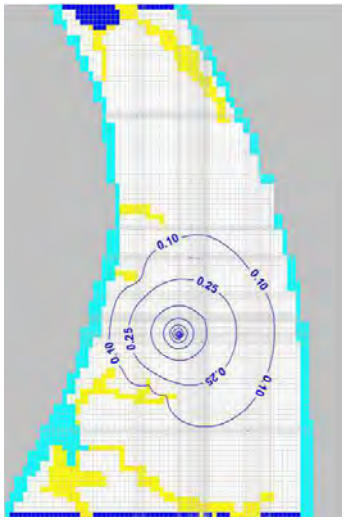


Quail Ridge B

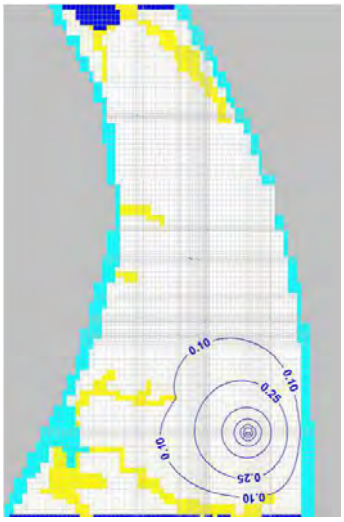


Modeled Drawdown

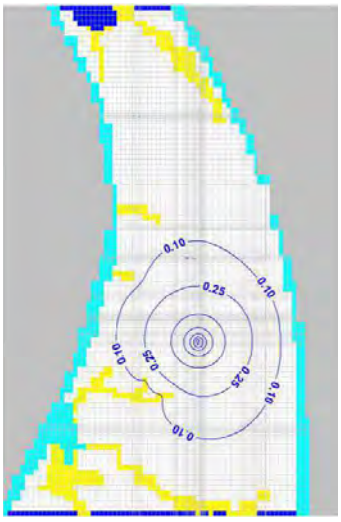
Walsh Site A



C-5



Quail Ridge B



Next Steps – Determine Additional Modeling Runs

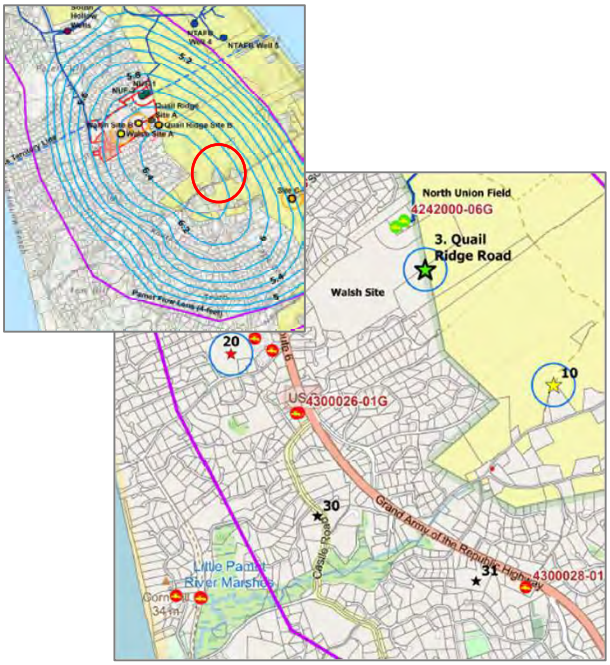
Discussion – Potential Additional Modeling Scenarios

1. No additional modeling with Highland Road.
2. Model supplemental summer use of NTAFB Wells?
3. Incorporation of Prince Valley Road – need initial model results.
4. Model Run 1: Site C-5 (and/or Prince Valley Road) and Walsh Site A [or Quail Ridge B]. Current Conditions or with Pamet River Restoration?
5. Model Run 2: To be Determined based on Run 1.
6. Run model to evaluate potential impacts to public water supply wells associated with future Sea Level Rise
   - Two Model Scenarios with 1, 3, and 6 feet of sea level rise
     - One current conditions and one with Pamet River Restoration?
     - Vary which sites are pumping depending on results of Model Runs 1 and 2 (above) (i.e., Site C-5 vs. Prince Valley Road or Walsh Site A vs. Quail Ridge B)?
   - Sites to include would depend on results of combined pumping model runs (i.e., pumping impacts to Pamet River with both Site C-5 and Prince Valley Road pumping)

37 APEX COMPANIES, LLC

Possible Additional Site

- Long Nook Road
- The northern part of the parcel appears undeveloped with a structure located on the southern part of the property close to Long Nook Road. The parcel is surrounded by National Seashore to the north. A well could be located greater than 400 feet from the structure on undeveloped land. There is a privately owned parcel to the southwest which would require ownership/easement for the undeveloped portion within the Zone I. However the parcel is in close proximity to Little Pamet River and potential impacts would need to be assessed as well as impacts to NUF, Site C-5 etc.



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Conclusions

1. A detailed desktop study was conducted to identify parcels that are large enough to support a MassDEP required 400-foot Zone I. This study included both Town-owned and private parcels.
2. A total of 33 locations were identified that could support ownership or control of the MassDEP required 400-foot Zone I.
3. Potential water supply sites selected for groundwater modeling include 5 within the Pamet Lens aquifer and 1 within the Chequesset Lens aquifer.
4. Initial modeling show Highland Road Site and NTAFB Site are not potentially viable PWS sites due to limited freshwater lens resulting in saltwater upconing or lateral intrusion. NTAFB Site may be used seasonally or for emergency uses but additional modeling would be required to assess pumping impacts on water quality.
5. Two potentially viable PWS sites identified within Pamet Lens – Walsh Site A/Quail Ridge B and Site C-5. Walsh Site A preferable to Quail Ridge B with less impacts to NUF water quality.
6. Evaluations conducted in 2000- 2004 identified two potentially viable PWS sites – C-5 and NUF. NUF was permitted as a new PWS source in 2011.
7. Two new source desktop studies within the Pamet Lens identified the same two parcels for PWS development. These results show that although there are a lot of potential PWS sites within the Pamet lens, potentially viable new water supply sources are extremely limited, and the two sites should be preserved for public water supply development.
8. To best preserve the Quail Ridge B site or Walsh Property Site A, wastewater from any development on the Walsh Property should be directed to the west of Route 6.
9. Due to the limited availability of potentially viable PWS sites, identified potential new sources and exiting water supply sources need to be protected from future impacts.

Groundwater Modeling – Schedule/Milestones

- 10/16/2025
  - Groundwater Model Update
  - Model Quail Ridge B Site
- 12/10/2025 All Things Water and Wastewater
  - Model results for new source locations (6 Sites Individually)
  - Determine additional Model Run 1 (modified pumping rates or multiple wells pumping)
  - Discussion of proposed Sea Level Rise Modeling
- 1/08/2026
  - Combined Pumping Model Run 1 Results
  - Determine Combined Pumping Model Run 2.
  - Discuss Initial Sea Level Rise Model Run
- 1/22/2026
  - Combined Pumping Model Run 2 Results
  - Identify Sea Level Rise Model Run 1
- 2/05/2026
  - Sea Level Rise Model Run 1 Results for 1, 3, and 6 feet of sea level rise.
  - Identify Sea Level Rise Model Run 2
- 2/19/2026 or 3/05/2026
  - Sea Level Rise Model Run 2 Results for 1, 3, and 6 feet of sea level rise.
- 4/02/2026
  - DRAFT Report

2 Water Demands

Truro Water Demands Analysis Update

- Reviewed build-out tables for residential and commercial districts and updated based on present conditions.
- Submitted request to Town to confirm future projects and developable parcels.

Methodology

Project Specific Demand Data

- Use anticipated projects and number of units to forecast future water demand
- Use historical per capita demand as reference

Provincetown Water Demands Analysis Update

- Submitted request to Town to confirm future development projects. Town confirmed that projects listed in 2024 Community Housing Report are still applicable.

Projects Pending	Total Units
33 Conwell St.	16
27 Winthrop/34 Court St	6
22/R & 24 Nelson	60
288A Bradford	15
3 Jerome Smith Road (40B)	65
207 Rt. 6 Barracks *(+ 112 dorms)*	13
227R Commercial	4
307 Commercial	4
26 Shank Painter	40
44 Captain Bertie's	36
Total Projects Pending	259

Average Daily Withdrawal

2022: 750,000 gpd | 2023: 700,000 gpd | 2024: 740,000 MGD

Methodology

Project Specific Demand Data

- Use anticipated projects and number of units to forecast future water demand
- Use historical per capita demand as reference

3 Discussion

10-16-2025

Monthly Meeting

Regional Water Supply and Watershed Management Study – 10/16/2025

1. Groundwater Modeling
   - Quail Ridge B Results
   - Model Update
2. Water Demands

APEX

1 Groundwater Modeling

APEX

New Source Water Supply Desktop Study - Groundwater Modeling of Selected Sites

Apex to model Four potential new source water supply well sites + NTAFB Wells:

- Quail Ridge Site B
- Site C-5
- Highland Road Site
- Prince Valley Road Site
- NTAFB Wells

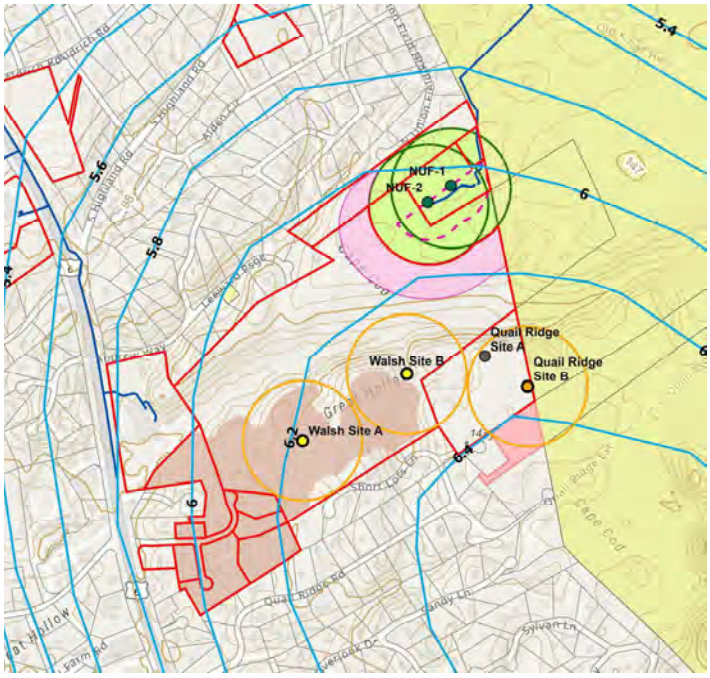
Groundwater Model – Scope

1. Model Quail Ridge B Site
2. Update Pamet Lens Model, Add Chequesset Lens, and Incorporate Pamet River Restoration
3. Incorporate 4 proposed potential public water supply sources.
4. Model each source separately to evaluate potential salinity impacts
5. Conduct up to two additional modeling scenarios based on individual well results.
6. Run model to evaluate potential impacts to public water supply wells associated with future Sea Level Rise – (1, 3, and 6 feet of sea level rise)

Quail Ridge B – Model Results

Quail Ridge B Site

- Quail Ridge Site A was previously evaluated (1,100 feet south NUF)
  - Would require a portion of the Walsh property for Zone I control
  - Previous assessment indicated that a well at this location would interfere with the NUF Wells and result in saltwater up-coning at higher pumping rates
- Quail Ridge Site B is approx. 330 feet southeast of Quail Ridge Site A
  - The potential well location is on a parcel owned the by Town of Truro
  - Does not require the Walsh Property and is outside the proposed development area
  - Requires parcel to the south for Zone I. (map 43 parcel 225)
  - The Quail Ridge Site A model was used to model Quail Ridge Site B Site.



Quail Ridge B Model

- Updated Existing Long Term Pumping Model to include Quail Ridge Site B Well Location
- Utilized pumping rates from previous Quail Ridge Site A Scenario 3:

Wells	Winter Rate (Nov – Apr) - gpd	Summer Rate (May – Oct) - gpd
Quail Ridge B	150,000	350,000
NUF-1	83,513	166,188
NUF-2	102,071	203,118
South Hollow	220,789	548,904
Knowles Crossing	68,689	139,090
NTAFB	198,018	296,367

Table 1. Seasonal Pumping Rates – Model Scenario 1

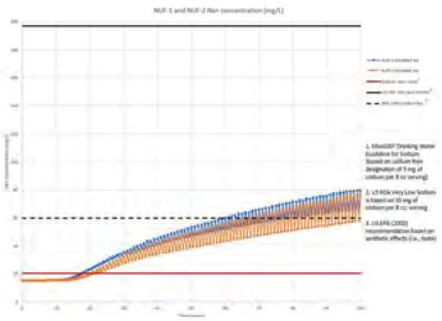
Source	Pumpage (gpd)	
	Winter Rate (Nov – Apr)	Summer Rate (May – Oct)
New Source	200,000	500,000
NUF-1	64,422	131,141
NUF-2	121,162	238,165

Table 2. Seasonal Pumping Rates – Model Scenario 2

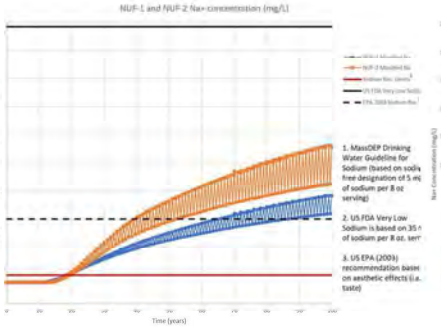
Source	Pumpage (gpd)	
	Winter Rate (Nov – Apr)	Summer Rate (May – Oct)
New Source	200,000	500,000
NUF-1	75,000	100,000
NUF-2	100,000	150,000

Modeled Sodium Concentrations – Comparisons

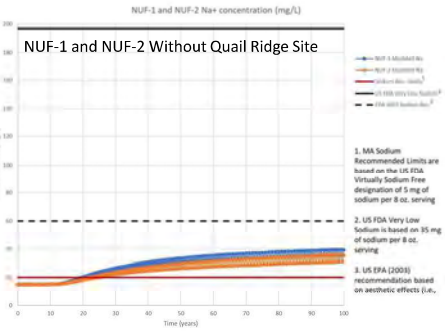
Quail Ridge Site B Pumping



Quail Ridge Site A Pumping



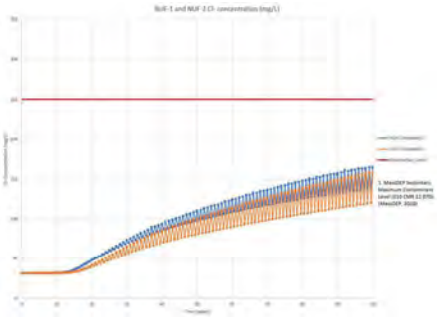
NUF1 and NUF-2 Wells Only Pumping



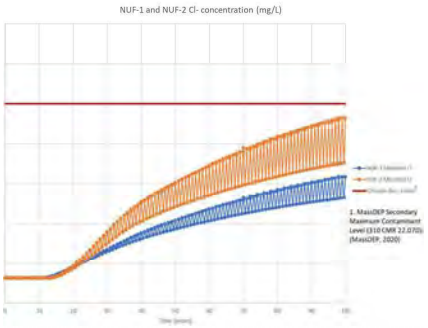
DRAFT – For Discussion Purposes Only

Modeled Chloride Concentrations – Comparisons

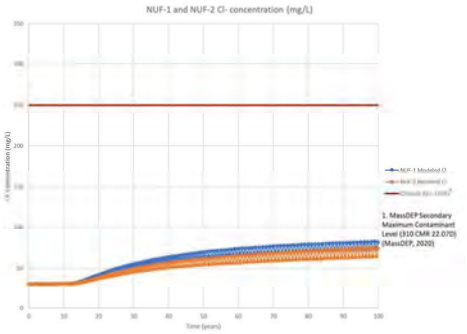
Quail Ridge Site B Pumping



Quail Ridge Site A Pumping

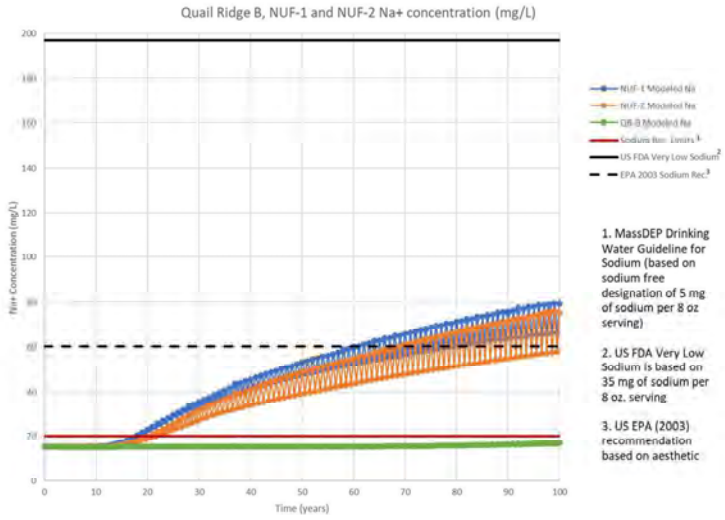


NUF1 and NUF-2 Wells Only Pumping



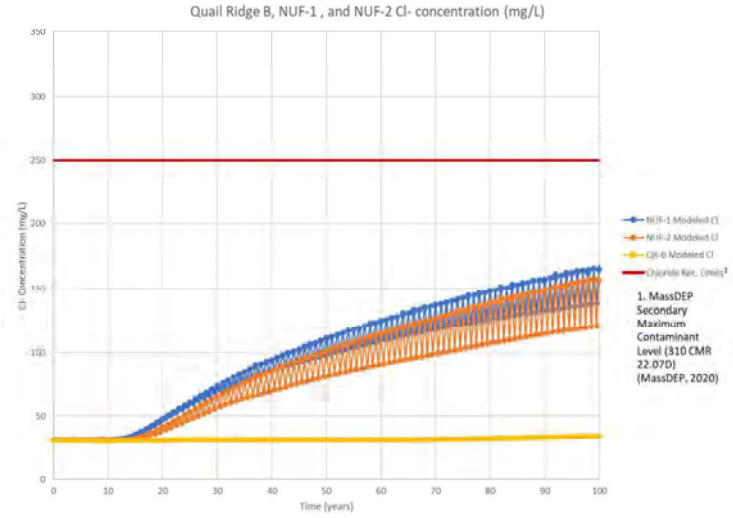
Quail Ridge Site B – Model Scenario 1

Quail Ridge B, NUF-1, and NUF-2 – Modeled Sodium Concentrations



Quail Ridge Site B – Model

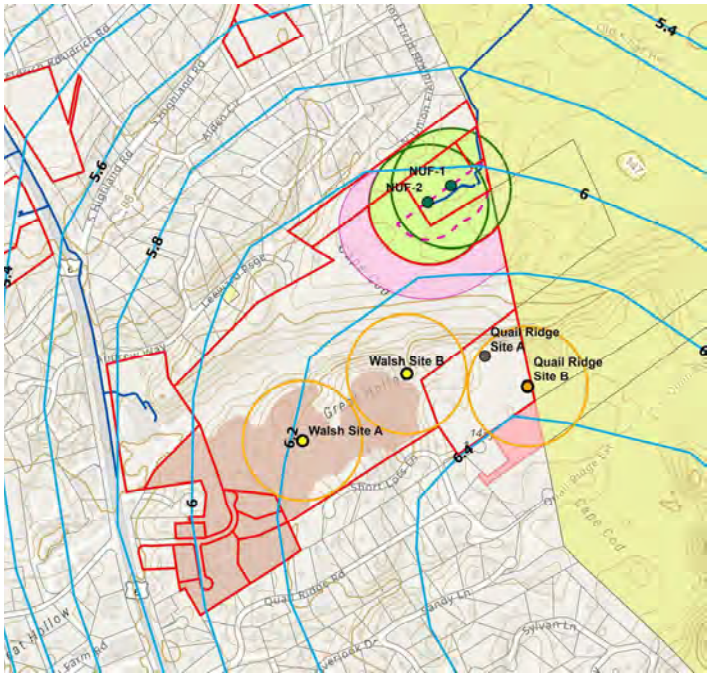
Quail Ridge B, NUF-1, and NUF-2 – Modeled Chloride Concentrations



DRAFT – For Discussion Purposes Only

Quail Ridge B Site

- Quail Ridge Site B is approx. 1,430 feet south of NUF and 330 feet southeast of Quail Ridge Site A
- Quail Ridge B site has less impacts to NUF Wells possibly due to Quail Ridge B located higher up on the Pamet Lens
- Other potential well locations on the Walsh Property would be higher on the Pamet Lens and on the Cape Cod Bay side of the lens, suggesting less impacts to NUF wellfield.



Potential New Source Sites

- Intermunicipal Agreement references new well fields to be located outside Zone II for existing well fields
- Not a DEP requirement
  - Quail Ridge Site B – within existing Zone II
  - Highland Road Site – within existing Zone II
  - Site C-5 – outside
  - Prince Valley Road Site – outside
- Zone II Recharge Mass Balance Screening
  - Total recharge within Zone IIs = 2.6 MGD
  - Total withdrawals = 1.8 MGD **
  - Recharge not being pumped = 0.8 MGD

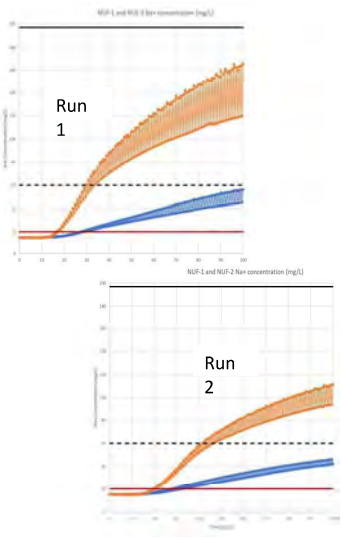
** Assumes Pumping at NUF=0.734 MGD, South Hollow=0.8 MGD, NTAFB estimated 0.3 MGD

System. The Town of Provincetown agrees that any new well fields developed after the North Union Well Field becomes operational will be located outside of the zone of contribution of existing well fields of the PWS.

Next Steps - Model 4 Proposed New Source Sites

Groundwater Modeling – Evaluate Potential Sites

- Model each new source location separately with the existing wells pumping (4 new source sites + NTAFB)
  - Evaluate potential salinity impacts
  - Evaluate associated drawdowns in the vicinity of the Pamet River (Site C-5 and Prince Valley Road)
  - Evaluate potential impacts to existing sources (NUF and South Hollow)
- Identify proposed pumping rate
- Review model results with group and conduct up to 2 additional model runs
- Determine proposed pumping rates and combination of wells for the new sources for sea level rise analyses



Site Specific Pumping Rate Concerns

- Quail Ridge Site
  - Potential Impacts to NUF Wells
  - Preliminary modeling indicates Summer pumping at 350,000 gpd may be feasible. 500,000 gpd – unacceptable impacts to NUF wells.
- Highland Road Site
  - Potential Impacts to South Hollow Wellfield Wells
  - Furthest north – Potential saltwater upconing/ intrusion due to thinner freshwater lens
- NTAFB Wells
  - Historic average Summer pumping 296,367 gpd but no assessment of water quality impacts.
  - Potential Impacts to NUF Wellfield Wells
  - Furthest east – Potential saltwater upconing/ intrusion due to thinner freshwater lens and proximity to Atlantic Ocean

Site Specific Pumping Rate Concerns

- Site C-5
  - Potential Pumping Impacts to Pamet River
  - Potential saltwater upconing/intrusion due to thinner freshwater lens
  - Preliminary modeling of pumping impacts from saltwater upconing/intrusion indicates potential withdrawal of 450,000 gpd
- Prince Valley Road Site
  - Potential Pumping Impacts to Pamet River
  - Potential Pumping Impacts to Great Pond, Snow Pond and Ryder Pond
  - Potential PFAS water quality impacts from Closed Landfill

Groundwater Modeling – Proposed Baseline Pumping Scenario

Table 1. Seasonal Pumping Rates – Model Scenario 1

Source	Pumpage (gpd)	
	Winter Rate (Nov – Apr)	Summer Rate (May – Oct)
New Source	200,000	350,000
NTAFB	198,018	296,367
NUF-1	64,422	131,141
NUF-2	121,162	238,165
South Hollow	220,789	548,904
Knowles Crossing	68,689	139,090
Total Withdrawal	873,080	1,703,667

- Pumping rates for existing sources based on average observed seasonal rates measured between 2017-2023
  - Except NTAFB wells, which are based on based on average rates from 2007-2010, because the recent pumping data was sporadic.
- Pumping rate for proposed new source based on anticipated future water needs and possible multi-straw pumping approach

Groundwater Modeling – Update Existing Model

- Refined model at existing sources and proposed potential new source locations
  - Grid spacing and well depths
  - Aquifer characteristics
- Site C-5 Updates
  - Apex 2002 – 2004 Pumping Test Reports
- Highland Road Site Updates
  - Data from South Hollow Wellfield 0.3 miles south
- Prince Valley Road Site
  - Incorporate USGS Chequesset Lens Model
- Pamet River Restoration
  - Need predicted tidal elevations post restoration

Groundwater Modeling – Schedule/Milestones

- 10/16/2025
  - Complete Groundwater Model Update
  - Model Quail Ridge B Site
- 11/13/2025
  - Model Results for new source locations (5 scenarios)
  - Determine additional modeling runs (modified pumping rates or multiple wells pumping)
- 11/20/2025 (Technical Working Group Interim Meeting)
  - Present Model Results
  - Discussion of Proposed Sea Level Rise Modeling
- 12/11/2025
  - Initial Sea Level Rise Model Results
- 1/08/2026
  - Sea Level Rise Model Results for 1, 3, and 6 feet of sea level rise for two separate pumping configurations

2 Water Demands

Truro Water Demands Analysis Update

- Reviewed build-out tables for residential and commercial districts and updated based on present conditions.
- Submitted request to Town to confirm future projects and developable parcels.

Methodology

Project Specific Demand Data

- Use anticipated projects and number of units to forecast future water demand
- Use historical per capita demand as reference

Provincetown Water Demands Analysis Update

- Submitted request to Town to confirm future development projects. Town confirmed that projects listed in 2024 Community Housing Report are still applicable.

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Total Projects Pending	259

Average Daily Withdrawal

2022: 750,000 gpd | 2023: 700,000 gpd | 2024: 740,000 MGD

Methodology

Project Specific Demand Data

- Use anticipated projects and number of units to forecast future water demand
- Use historical per capita demand as reference

3 Discussion

09-18-2025

Monthly Meeting

Regional Water Supply and Watershed Management Study – 9/18/2025

1. Groundwater Modeling
2. Water Demands

APEX

Groundwater Modeling of Selected Sites

August 28, 2025 Meeting Summary

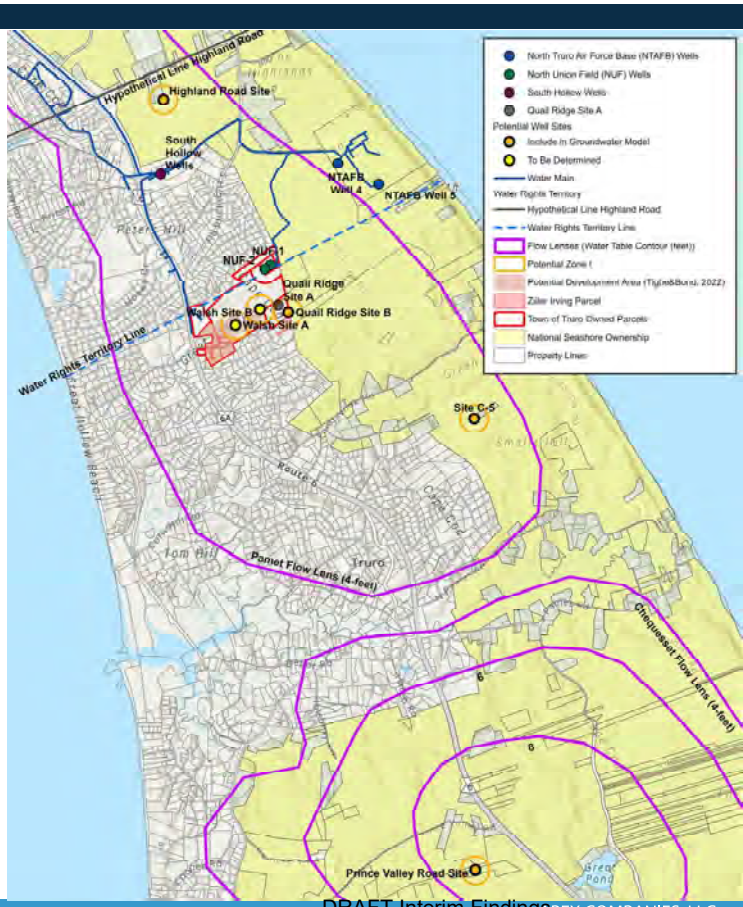
- Apex presented an overview of the preferred sites identified by the Town of Truro and Town of Provincetown
- Apex will proceed with modeling the four potential well sites that both towns agree upon:
  - NTAFB Wells
  - Quail Ridge Site B
  - Site C-5
  - Highland Road Site
  - Prince Valley Road Site

1 Groundwater Modeling

New Source Water Supply Desktop Study - Results

Four potential new source Water supply well sites:

- NTAFB Wells
- Quail Ridge Site B
- Site C-5
- Highland Road Site
- Prince Valley Road Site



Groundwater Model – Updated Scope

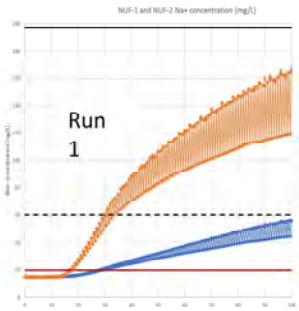
1. Update Pamet Lens Model, Add Chequesset Lens, and Incorporate Pamet River Restoration
2. Incorporate 5 proposed potential public water supply sources and model each source separately to evaluate potential salinity impacts
3. Conduct up to two additional modeling scenarios based on individual well results.
4. Run model to evaluate potential impacts to public water supply wells associated with future Sea Level Rise
    - 1, 3, and 6 feet of sea level rise for two separate pumping configurations

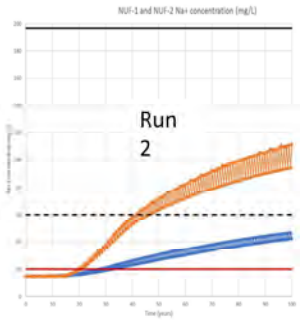
Groundwater Modeling – Update Existing Model

- Apex compiling information to update model
- Pamet River Restoration
    - Pamet River – Working Group and Woods Hole Group Reports
    - Herring River – USGS Reports
    - Apex 2004 Pumping Tests from wells along Pamet River and Little Pamet River
    - Water level monitoring data from Truro website
- Site C-5 Updates
    - Apex 2002 – 2004 Pumping Test Reports
- Highland Road Site Updates
    - Data from South Hollow Wellfield 0.3 miles south
    - Campground Site Well Data
- Prince Valley Road Site
    - Incorporate USGS Chequesset Lens Model

Groundwater Modeling – Evaluate Potential Sites

- Model each new source location separately with the existing wells pumping (4 model runs)
  - Evaluate potential salinity impacts
  - Evaluate associated drawdowns in the vicinity of the Pamet River (Site C-5 and Prince Valley Road)
  - Evaluate potential impacts to existing sources (NUF and South Hollow)
- Review model results with group and conduct up to 2 additional model runs
- Determine proposed pumping rates and combination of wells for the new sources for sea level rise analyses





Groundwater Modeling – Baseline Pumping Scenario

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NUF-2	121,162	238,165
South Hollow	220,789	548,904
Knowles Crossing	68,689	139,090

Note: Total Wellfield pumpage for South Hollow, Knowles Crossing, and NTAFB Wells was split evenly between wells in each wellfield.

- Pumping rates for existing sources based on average observed seasonal rates measured between 2017-2023
  - Except NTAFB wells, which are based on based on average rates from 2007-2010, because the recent pumping data was sporadic.
- Pumping rate for proposed new source based on anticipated future water needs.

Groundwater Modeling – Schedule/Milestones

- 10/16/2025
  - Complete Groundwater Model Update
  - Model Quail Ridge B Site
- 11/6/2025 and 11/20/2025
  - Model Results for new source locations (5 scenarios)
  - Determine additional modeling runs (modified pumping rates or multiple wells pumping)
- 12/4/2025 and 12/18/2025
  - Model Results for 1, 3, and 6 feet of sea level rise for two separate pumping configurations
- 1/22/2026
  - Review modeling results and DRAFT Report

2 Water Demands

Truro Water Demands Analysis

- Methodology
  - Review existing reports and data to assess existing and future conditions
    - *Integrated Water Resources Management Plan (IWRMP), Phase 1* (2014, Weston & Sampson)
    - *Housing Needs Assessment and Production Plan* (2025, JM Goldson, LLC)
    - *Town of Truro Local Comprehensive Plan* (2023, Local Comprehensive Plan Committee)
- Method 1: ADD Using Water Consumption (65 gpcd)
  - Current Population (2,454), Year-Round: 159,510 gpd
  - Full Buildout (2,713), Year- Round: 176,345 gpd
- Method 2: ADD Using Wastewater Projections (2014 IWRMP)
  - Full Buildout, Year- Round: ~109,000 gpd
  - Full Buildout, Summer Population: ~499,000 gpd

Provincetown Water Demands Analysis

- Methodology
  - Review and update the 2023 Water System Demands Assessment (*Apex)*
  - Review *Managed Growth & Growth Management and Forecast Increase Water Needs* (John Goodrich, 2022)

- Average ADD (2022 – 2024): 0.73 MGD
- MDD (2022 – 2024): 1.73 MGD – 1.75 MGD
- Average RGPCD (2022 – 2024): 51 gpcd

3 Discussion

08-28-2025

Monthly Meeting

DRAFT

Regional Water Supply and Watershed Management Study – 8/28/2025

1. Groundwater Modeling Progress Update
2. Discussion of Potential New Source Water Supply Sites

APEX

1

DRAFT

1 Groundwater Modeling Progress Update

APEX

2

Groundwater Model Outline

DRAFT

Task 1 – Project Kick-off and Identify Model Scenarios

Task 2 – Update/Refine Existing Model

Task 3 – Modeling Analyses to Evaluate 2 Potential Well Locations

Task 4 - Sea Level Rise Modeling

Task 5 - Meet with Project Team to Discuss Results

Task 6 - Prepare Technical Memo

3

TASKS 1-3 Groundwater Model

DRAFT

Task 1 - Identify model scenarios

- Confirm pumping configuration for existing water supply wells
- Select potential new well source locations for incorporation into the model
  - Identify pumping scenarios for each of the potential new source locations (2 pumping scenarios will be modeled for each location)
- Provide relevant studies, reports and models documenting restoration of the Pamet River to facilitate updates to model
  - Received studies from Town of Truro DPW website (Truro Center Road/Pamet River Deliverables)
  - Seeking any preliminary modeling or reports available on the restoration plan
- Approximately 5-6 weeks to complete the model once all modeling parameters and files are complete

Quail Ridge Site - Pumping Rates (GPD)

Source	November-April	July/August
New Source Truro	200,000	500,000
NUF 1	64,422	131,141
NUF 2	121,162	238,165
South Hollow	220,789	548,904
Knowles Crossing	68,689	139,090
NTAFB	198,018	296,367

4

TASKS 1-3 Groundwater Model

DRAFT

Task 2 - Update/refine existing model

- Expand the model to better represent public water supply wells
  - Incorporate recent well pumping data
  - Add potential new water supply sources
- Refine the model grid to better represent the Knowles Crossing, South Hollow, and NTAFB wells
- Update the Pamet River model boundary conditions to represent the planned restoration

APEX COMPANIES, LLC

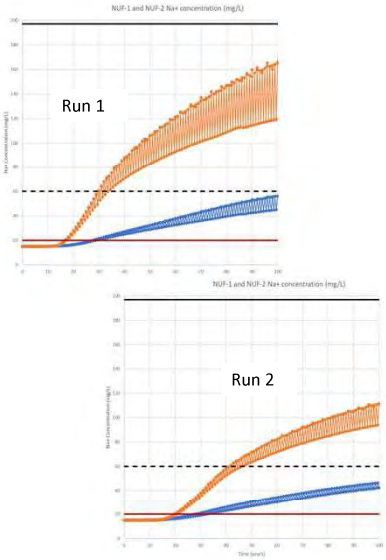
5

TASKS 1-3 Groundwater Model

DRAFT

Task 3 - Perform modeling analyses to evaluate potential new well site locations

- Two pumping scenarios will be performed for each potential well site
- Evaluate potential salinity impacts associated with new potential well locations
  - Based on current conditions
  - Baseline conditions are existing conditions in the NUF model
- Meet with team to review results of modeling scenarios
  - Identify optimal pumping scenario
  - Discuss the potential new source location



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6

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2 Discussion of Potential New Source Water Supply Sites

APEX

7

Potential New Source Water Supply Sites

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July 24, 2025 Meeting Summary

- Apex presented a preliminary desktop assessment of potential new source water supply sites
- Sites were ranked based on:
  - Ability to obtain ownership/control of Zone I
  - Potential for saltwater intrusion/up-coning
  - Proximity to sensitive environmental receptors (i.e., Pamet River or Little Pamet River, vernal pools, etc.)
  - Distance from existing system
  - Potential interference with existing wells
  - Location relative to the lens
- The Town of Truro and Town of Provincetown provided review comments and feedback on favorable sites

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8

Potential New Source Water Supply Sites

DRAFT

Potential New Source Sites

- 32 sites were identified during the preliminary desktop study
- Preferred sites have been selected based on review feedback from the team

Preliminary Desktop Assessment for Favorable Well Sites in Truro, MA

Site ID Favorability	Parcel ID	Description
7 Moderate (CCC Site)	39_78_0 39_77_0	[illegible]
8 Moderate	36_171_0	[illegible]
9 Moderate	37_10_0	[illegible]
10 Moderate	43_118_0 43_120_0	[illegible]
11 Moderate (CCC Site)	47_9_0 47_6_0 47_117_0	[illegible]
12 Moderate (CCC Site)	47_121_0 47_132_0 47_142_0	[illegible]
13 Moderate (CCC Site)	51_80_0 51_81_0 51_79_0 51_76_0 51_87_0 PRIV_ROW	[illegible]
14 Moderate	51_61_0	[illegible]
15 Moderate	54_92_0	[illegible]
16 Moderate	55_20_0	[illegible]

Preliminary Desktop Assessment for Favorable Well Sites in Truro, MA

Site ID Favorability	Parcel ID	Description
1 High	36_183_0 36_184_0	Two privately owned parcels located south of Highland Road and surrounded by the National Seashore. The existing structures on the parcels appear to be located adjacent to the road. There is potential to site a well on the southern undeveloped part of the parcels farther from Highland Road. This site is high priority due to its distance from the coast and surface water features. A well could be developed greater than 400 feet from existing structures on a portion of the undeveloped land. Potential interference with the South Hollow Wells (~2,000 ft south) would need to be assessed.
2 High	37_20_0	The two NTAFB Wells are owned by the NPS CCNS. The estimated safe yield for the wells is 0.57 MGD although CCNS maximum daily limit is 0.33 MGD. These wells have been used by the Town of Provincetown for emergency purposes under a Special Use Permit. Use of these wells would require an agreement with the NPS, which may be difficult to obtain. The NPS Organic Act as amended, 16 USC Section 1a-2e and DO #35 A, places responsibility on the NPS to protect and regulate the use of national parks, including their water resources and NPS water can only be sold or leased to facilitate the administration of a national park.
3 High (CCC Site)	43_3_0 43_225_0 43_28_0 43_2_0 Walsh	This parcel is owned by the Town of Truro, is bordered to the east by CCNS property, and is approximately 1200 feet from NUF and water supply infrastructure. A water supply site on this parcel would require keeping a portion of the "Walsh Property" for Zone I wellhead protection. Preliminary modeling shows pumping at this site could result in additional saltwater upconing and increased sodium and chloride concentrations at the NUF Wellfield. Acquiring the two parcels to the south could enable the well to be moved further from NUF. Pumping this site at a lower pumping rate in combination with another source may be a viable alternative.
4 High (Site C-5)	44_10_0 (Site C5)	This parcel owned by the Town of Truro is located south of Higgins Hollow Road and near Smalls Hill. The parcel is surrounded by National Seashore. The site (C-5) was previously explored including installation of test well and stream piezometers, and groundwater modeling, which indicate a withdrawal at this location would be limited by potential impacts to the Pamet River (~4,200 ft south) and possibly the Little Pamet River (~5,000 ft west).
5 High (CCC Site)	51_91_0	This parcel is owned by the Town of Truro (Land Bank) and located east of RT 6 and southeast of Edgewood Way. There is conservation land to the northeast and the parcel is adjacent to the national seashore and appears to be undeveloped. It is located close to the Pamet River and potential streamflow impacts which would need to be assessed. This parcel is also located approx. 1,000 feet north of the closed Truro Landfill. This location is within the Chequesset flow lens rather than the Pamet flow lens.
6 High	60_1_0	This parcel is located south of Prince Valley Road and owned by the Town of Truro. The parcel is surrounded by National Seashore and access to the parcel would need to be considered. Parcel is 3,000 feet from Great Pond and impacts to pond levels need to be evaluated. It is located on the southern part of Truro and farther from the system but is farther from the coast. This parcel is approx. 2,000 feet south of a former fuel oil spill site. This location is within the Chequesset flow lens rather than the Pamet flow lens.

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9

Potential New Source Water Supply Sites

DRAFT

- **Town of Truro Review Comments on Preferred Sites**
  - Supports the strategy of the multi-straw approach to develop redundancy for the PWS
  - Emphasis on updating the feasibility of de-salinization, an aggressive UAW reduction program, and water conservation
    - Include in the development of the Management Plan
  - Identified the following sites for further investigation
    - Prince Valley Road (map 60, parcel 1, owned by Town of Truro
    - Site C-5 (map 44, parcel 10, owned by Town of Truro
    - Quail Ridge Site B
      - Quail Ridge Road (map 43, parcel 3, Town of Truro)
      - Requires parcels to the south for Zone I

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10

Potential New Source Water Supply Sites

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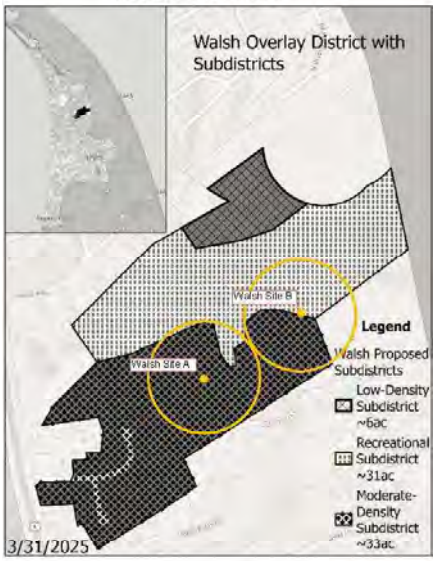
- **Town of Provincetown Review Comments on Preferred Sites**
  - Select board requested modeling of the Walsh Property
  - Apex identified potential sites Walsh Site A/B
    - Location A is as far from NUF as possible on the west side of the Pamet Lens (1,800 feet southwest of NUF-2)
    - Location B is closer to NUF and outside of the proposed development area (1,100 feet southwest of NUF-2)
  - Show the hypothetical preservation area on the Walsh Property for potential future replacement of the NUF wells (Zone I area)

Proposed Appendix C



Walsh Zoning Overlay - Draft Hypothetical Sites

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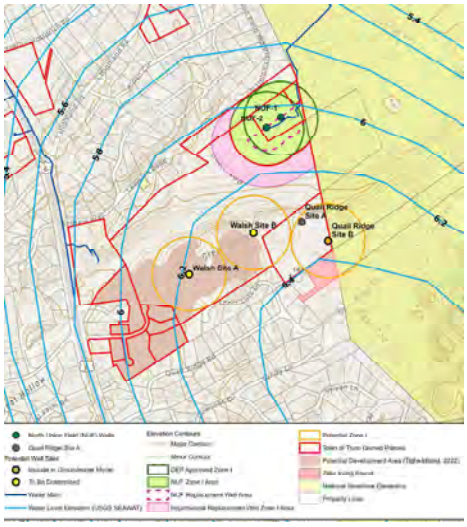
11

Potential New Source Water Supply Sites

DRAFT

- **Quail Ridge Site B**
  - Quail Ridge Site A was previously evaluated (1,100 feet south NUF)
    - Would require a portion of the Walsh property for Zone I control
    - Previous assessment indicated that a well at this location would interfere with the NUF Wells and result in saltwater up-coning at higher pumping rates
  - Quail Ridge Site B is approx. 330 feet southeast of Quail Ridge Site A
    - The potential well location is on Map 43, Parcel 3 owned the by Town of Truro
    - Does not require the Walsh Property and is outside of the proposed development area
    - Requires parcels to the south for Zone I
    - Model is already set up with Quail Ridge Site A and modeling Site B can be done before development of the expanded model (2 weeks)
  - Pumping a well at a lower pumping rate and in combination with another source may be a viable alternative



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12

"Water Rights Territory" - 1952 Special Act DRAFT

Massachusetts legislative act that authorizes the Town of Provincetown to supply itself and its inhabitants with water

Authorized to collect water from territory lying between Highland Road and a line 1.25-miles southeasterly and parallel to

May acquire water sources and related land by eminent domain, lease, purchase, gift, or other means

Requires approval from Department of Public Health for water source use and infrastructure layout

13

Potential New Source Water Supply Sites DRAFT

- **Highland Road Site**
  - Potential well site located within the "water rights territory"
  - Requires acquisition of a portion of two privately owned parcels located south of Highland Road
    - Possible through the 1952 act
    - Undeveloped land on southern portion of the parcels
  - Close to existing water infrastructure
  - Adjacent to the National Seashore
  - Farther from the coast
  - No nearby surface water bodies
  - Assess potential interference with South Hollow Wellfield
  - Obtain information on future plans for wastewater disposal for campgrounds to the southeast

14

Potential New Source Water Supply Sites

DRAFT

- **Site C-5**
  - Town-owned parcel surrounded by National Seashore
  - Approx. 2 miles from the water system
  - Site C-5 is approximately 1 mile north of the Pamet River and one mile east of the Little Pamet River
  - Drilling, testing, and groundwater modeling was conducted in 2003-2006
  - Pamet River/Little Pamet River Groundwater and Surface Water Investigation Report (November, 2006, EP)
    - Lack of hydraulic connection between the surface water and groundwater suggest few impacts to Little Pamet River
    - Study indicated close hydraulic connection between surface water/groundwater at the Pamet River which would need to be further evaluated
  - Potential well yield for C-5 was estimated to be 0.45 MGD based on groundwater modeling and previous study (based on very generalized assumptions about aquifer characteristics which could change as additional lithologic information is gained)
  - Obtain information from Truro and the Woods Hole Group on the Pamet River Restoration Plan for further evaluation

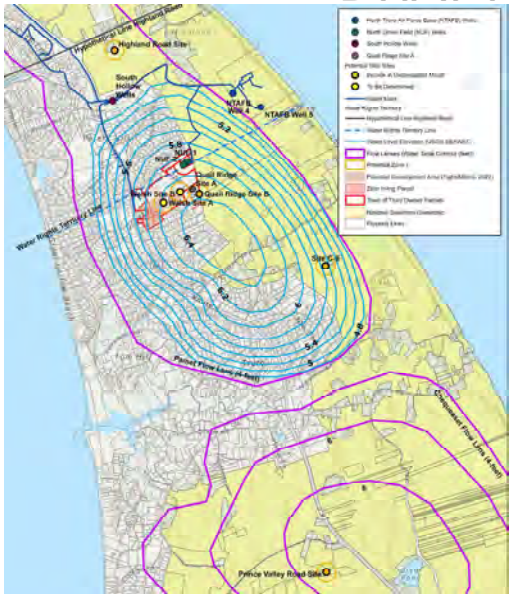
Figure 1: Well & Gauge Locations Site C-5 Truro, MA

15

Potential New Source Water Supply Sites

DRAFT

- **Prince Valley Road Site**
  - Owned by the Town of Truro
  - Undeveloped land surrounded by the National Seashore
  - Farther from the coast (lower concern for saltwater intrusion/up-coning)
  - Proximity to closed Truro Landfill
  - Located within the Chequesset Flow Lens
  - Spreads out the withdrawals and promotes the multi straw approach
  - Located far from existing water infrastructure (approx. 3.7 miles)
  - Assess potential impacts to the Pamet River and Great Pond
  - Model this site using the USGS outer cape model



16

Proposed Groundwater Modeling Program

DRAFT

Select potential well sites for evaluation

Apex recommends modeling all sites

Direction on next steps is required

- NTAFB Wells are in the existing model
- Model Quail Ridge Site B (Quail Ridge Site A is in the existing model)
- <u>Potential sites discussed</u>
  - Site C-5
  - Highland Road Site
  - Walsh Site A/B
  - Prince Valley Road Site

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17

07-24-2025

Monthly Meeting

Regional Water Supply and Watershed Management Study – 7/24/2025

1. Groundwater Modeling Scope
2. Potential New Source Water Supply Sites

1 Groundwater Modeling Scope

Groundwater Model Outline

- Task 1 – Project Kick-off and Identify Model Scenarios.
- Task 2 – Update/Refine Existing Model.
- Task 3 – Modeling Analyses to Evaluate 2 Potential Well Locations.
- Task 4 - Sea Level Rise Modeling.
- Task 5 - Meet with Project Team to Discuss Results.
- Task 6 - Prepare Technical Memo

TASK 1 – Groundwater Model

- **Project kick-off and Identify Model Scenarios.**
  - Confirm pumping configuration for existing water supply wells – **week of 7/28**
  - Identify 2 potential new source locations for incorporation into the model – **week of 7/28**
  - Identify pumping scenarios for each of the 2 potential new source locations (a total of 2 pumping scenarios will be modeled for each location) – **week of 7/28**
  - Identify relevant studies, reports and models documenting restoration of the Pamet River to facilitate updates to model. Truro to provide this information – **week of 8/4**
- 8 – 10 Weeks to Complete the Model once ALL modeling parameters and files are complete.

Quail Ridge Site - Pumping Rates (GPD)

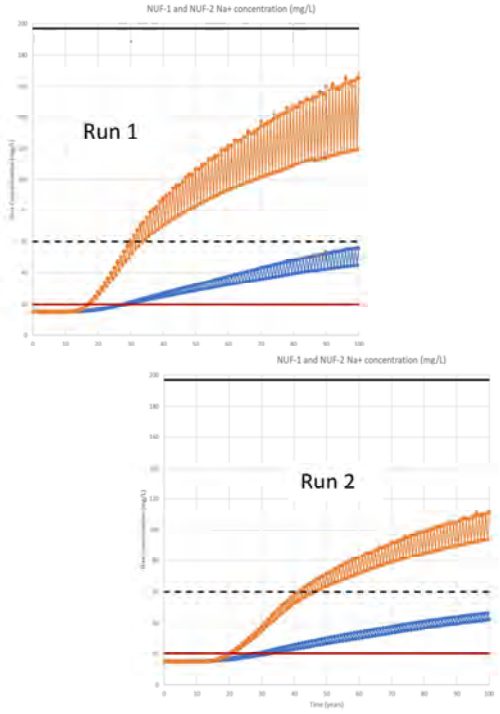
Source	November-April	July/August
New Source Truro	200,000	500,000
NUF 1	64,422	131,141
NUF 2	121,162	238,165
South Hollow	220,789	548,904
Knowles Crossing	68,689	139,090
NTAFB	198,018	296,367

TASK 2 – Groundwater Model

- **Update/refine existing model to better represent public water supply wells within the watershed and incorporate recent well pumping data, add potential new water supply sources, and reflect the future Pamet River restoration.**
  - Refinement of the model grid to better represent the Knowles Crossing, South Hollow, and NTAFB wells.
  - Addition of the 2 potential locations for additional water supply wells.
  - Update Pamet River model boundary conditions to represent planned restoration.
  - Any refinements to aquifer hydraulic properties in the vicinity of these wellfields will only be performed if readily apparent (significant refinements could eat up a lot of the budget).

TASK 3 – Groundwater Model

- **Perform modeling analyses to evaluate potential salinity impacts associated with new potential well locations (based on current conditions).**
  - Baseline conditions would be existing conditions in the NUF model.
  - A total of two pumping scenarios will be performed for each potential water supply well location.
  - Meet with Team to review results of modeling scenarios and identify optimal pumping scenario and potential new source location.



TASK 4 – Groundwater Model

Lagoon Pond: 6-Foot Sea Level Rise

- **Task 4a - Compile and analyze information and data to identify future sea level rise scenarios. Generate GIS files to facilitate model updates for sea level rise scenarios – Propose 2, 4, and 6 feet.**
  - Surging Seas Risk Finder for Provincetown states:
    Based on the National Climate Assessment intermediate high sea level rise scenario, we project 4.1 feet of rise locally by 2100, from a 1992 baseline.
  - USGS Potential Effects of Sea-Level Rise on the Depth to Saturated Sediments of the Sagamore and Monomoy Flow Lenses on Cape Cod, Massachusetts, 2016.
    The 3D calibrated model was modified to represent sea levels of 2, 4, and 6 ft above the 2011 sea level and simulate water table altitudes corresponding to those sea levels.
  - GIS files will be generated to facilitate updates to model boundary conditions for sea level rise analyses
- **Task 4b - Update model boundary conditions and run model to evaluate potential impacts to public water supply wells associated with future sea level rise of 2, 4, and 6 feet.**
  - Pumping scenario will be chosen based on results from Task 3.
  - A total of three simulations will be performed to evaluate potential Salinity impacts to NUF, Knowles Crossing, South Hollow (if necessary), NTAFB Wells, and preferred new source location.

TASKS 5 and 6– Groundwater Model

- **Task 5 - Meet with project team to discuss results of analyses.**
- **Task 6 - Prepare Technical Memo summarizing analyses**

2 Potential New Source Sites

Potential New Source Water Supply Sites

- **Preliminary assessment and ranking of potential new source water supply sites:**
  - Ability to obtain ownership/control of the Zone I
    - Parcel ownership
    - Adjacent to National Seashore
    - Land use and existing structures
  - Location relative to the coast
    - Saltwater intrusion / up-coning
  - Proximity to Environmental Receptors i.e., Pamet River or Little Pamet River, vernal pools, etc.
  - Distance from the water system
  - Potential interference with existing wells
- **Ranking – High, Moderate, or Low**

Potential New Source Water Supply Sites

High Priority Well Sites

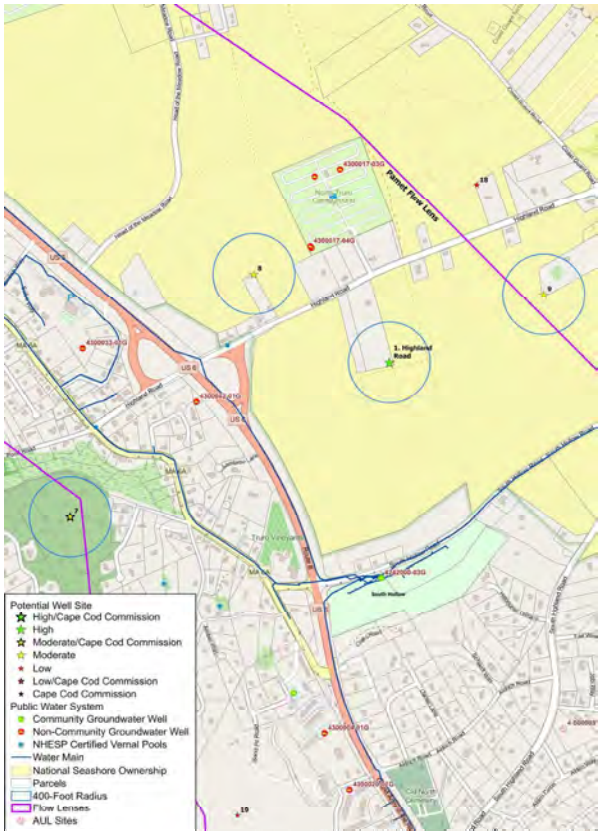
Preliminary Desktop Assessment for Favorable Well Sites in Truro, MA

Site ID Favorability	Parcel ID	Description
1 High	36_183_0 36_184_0	Two privately owned parcels located south of Highland Road and surrounded by the National Seashore. The existing structures on the parcels appear to be located adjacent to the road. There is potential to site a well on the southern undeveloped part of the parcels farther from Highland Road. This site is high priority due to its distance from the coast and surface water features. A well could be developed greater than 400 feet from existing structures on a portion of the undeveloped land. Potential interference with the South Hollow Wells (~2,000 ft south) would need to be assessed.
2 High	37_20_0	The two NTAFB Wells are owned by the NPS CCNS. The estimated save yield for the wells is 0.57 MGD although CCNS maximum daily limit is 0.33 MGD. These wells have been used by the Town of Provincetown for emergency purposes under a Special Use Permit. Use of these wells would require an agreement with the NPS, which may be difficult to obtain. The NPS Organic Act as amended, 16 USC Section 1a-2e and DO #35 A, places responsibility on the NPS to protect and regulate the use of national parks, including their water resources and NPS water can only be sold or leased to facilitate the administration of a national park.
3 High (CCC Site)	43_3_0 43_225_0 43_28_0 43_2_0 Walsh	This parcel is owned by the Town of Truro, is bordered to the east by CCNS property, and is approximately 1200 feet from NUF and water supply infrastructure. A water supply site on this parcel would require keeping a portion of the "Walsh Property" for Zone I wellhead protection. Preliminary modeling shows pumping at this site could result in additional saltwater upconing and increased sodium and chloride concentrations at the NUF Wellfield. Acquiring the two parcels to the south could enable the well to be moved further from NUF. Pumping this site at a lower pumping rate in combination with another source may be a viable alternative.
4 High (Site C-5)	44_10_0 (Site C5)	This parcel owned by the Town of Truro is located south of Higgins Hollow Road and near Smalls Hill. The parcel is surrounded by National Seashore. The site (C-5) was previously explored including installation of test well and stream piezometers, and groundwater modeling, which indicate a withdrawal at this location would be limited by potential impacts to the Pamet River (~4,200 ft south) and possibly the Little Pamet River (~5,000 ft west).
5 High (CCC Site)	51_91_0	This parcel is owned by the Town of Truro (Land Bank) and located east of RT 6 and southeast of Edgewood Way. There is conservation land to the northeast and the parcel is adjacent to the national seashore and appears to be undeveloped. It is located close to the Pamet River and potential streamflow impacts which would need to be assessed. This parcel is also located approx. 1,000 feet north of the closed Truro Landfill. This location is within the Chequesset flow lens rather than the Pamet flow lens.
6 High	60_1_0	This parcel is located south of Prince Valley Road and owned by the Town of Truro. The parcel is surrounded by National Seashore and access to the parcel would need to be considered. Parcel is 3,000 feet from Great Pond and impacts to pond levels need to be evaluated. It is located on the southern part of Truro and farther from the system but is farther from the coast. This parcel is approx. 2,000 feet south of a former fuel oil spill site. This location is within the Chequesset flow lens rather than the Pamet flow lens.

Potential New Source Water Supply Sites

1. Highland Road Sites

- Alternative – Two privately owned parcels located south of Highland Road
- Undeveloped land on the southern portion of these parcels for Zone I
- Adjacent to the National Seashore
- Farther from the coast and no nearby surface water bodies
- Private parcels would require land acquisition from multiple owners
- Assess potential interference with South Hollow Wellfield



Potential New Source Water Supply Sites

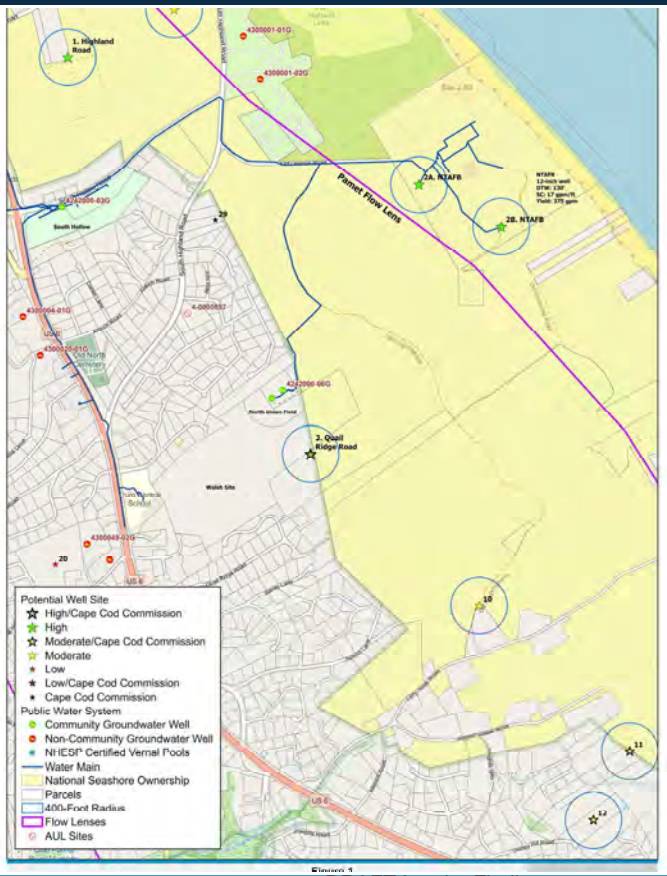
2A & 2B NTAFB Wells Cape Cod Conservation Trust Site

- Owned by NPS CCNS
- Estimated safe yield of 0.57 MGD
- Max. daily limit of 0.33 MGD
- Historical Special Use Permit
- Would require agreement with NPS for use of wells
- Proximity to coast - assess potential for saltwater intrusion/upconing

Potential New Source Water Supply Sites

3. Quail Ridge Road Site

- Owned the by Town of Truro
- Adjacent to Walsh Property and privately owned parcels
- Requires portion of Walsh Property for Zone I
- Previously assessed – interference with NUF Wells and saltwater upconing at higher pumping rates
- Pumping this site at a lower pumping rate in combination with another source may be a viable alternative



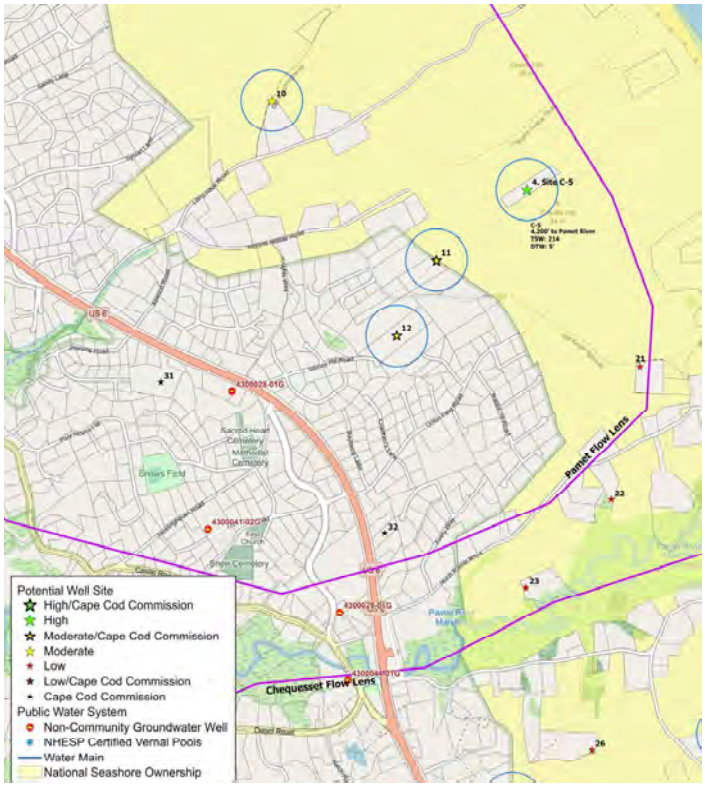
Potential New Source Water Supply Sites

4. Site C-5

- Town-owned parcel surrounded by National Seashore
- Drilling, testing, and groundwater modeling conducted in 2003-2006
- Potential well yield 0.45 MGD without unacceptable saltwater upconing
- Approvable well yield likely limited by potential impacts to Pamet River

10. Longnook Road

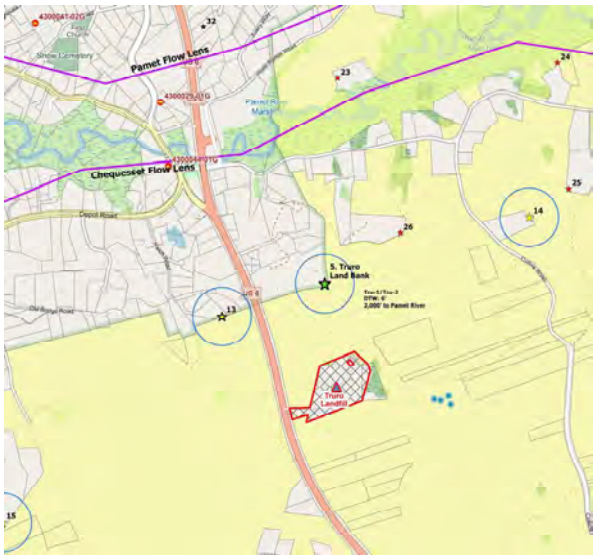
- Two privately owned parcels surrounded by National Seashore
- Undeveloped land on the northern portion of these parcels
- Potential pumping impact to Little Pamet River



Potential New Source Water Supply Sites

5. Truro Land Bank Site

- Owned by the Town of Truro Land Bank – Evaluate feasibility of using Land Bank property for water supply
- Undeveloped land adjacent to the National Seashore
- Farther from coast (lower concern for saltwater intrusion/upconing)
- Potential impacts to Pamet River
- Proximity to closed Truro Landfill
- Located in Chequesset Flow Lens



13. Truro Conservation Trust Site

- Privately owned undeveloped parcel (Private ROW to the north) and a second privately owned parcel within the Zone I
- Adjacent to Truro Conservation Trust property and north of National Seashore
- Farther from the coast (lower concern for saltwater intrusion/upconing)
- Potential impacts to Pamet River
- Proximity to closed Truro Landfill
- Located in Chequesset Flow Lens

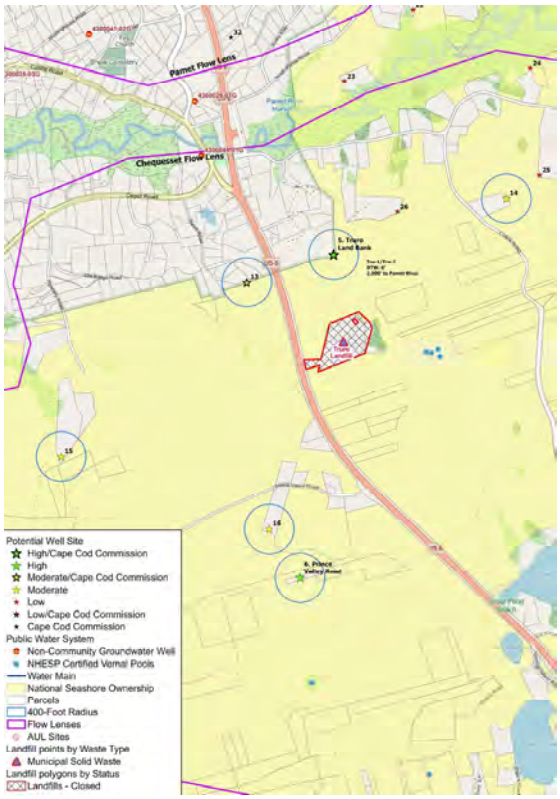
Potential New Source Water Supply Sites

6. Town-Owned Prince Valley Road Site

- Owned by the Town of Truro
- Undeveloped land surrounded by the National Seashore
- Feasibility to access the property
- Farther from the coast (lower concern for saltwater intrusion/upconing)
- Proximity to closed Truro Landfill
- Located in Chequesset Flow Lens
- Located far from existing water infrastructure

14. Privately-Owned Prince Valley Road Site

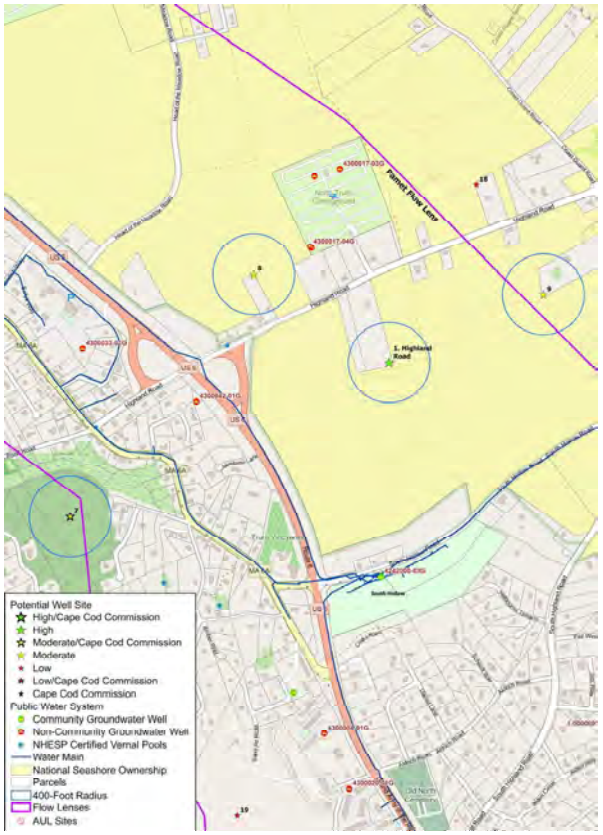
- Privately owned parcel surrounded by National Seashore
- Undeveloped land in southern portion of parcel
- Farther from the coast (lower concern for saltwater intrusion/upconing)
- Located in Chequesset Flow Lens
- Located far from existing water infrastructure



Potential New Source Water Supply Sites

7. Compact of CC Conservation Trust Site

- Parcel recently sold to Cape Cod Conservation Trust
- Parcel owned by Truro Conservation Trust to the southwest
- Undeveloped land on parcels for Zone I
- Assess distance from coast (saltwater intrusion/upconing)
- Potential impacts to sensitive environmental receptors (Village Pond & wetlands, vernal pool)



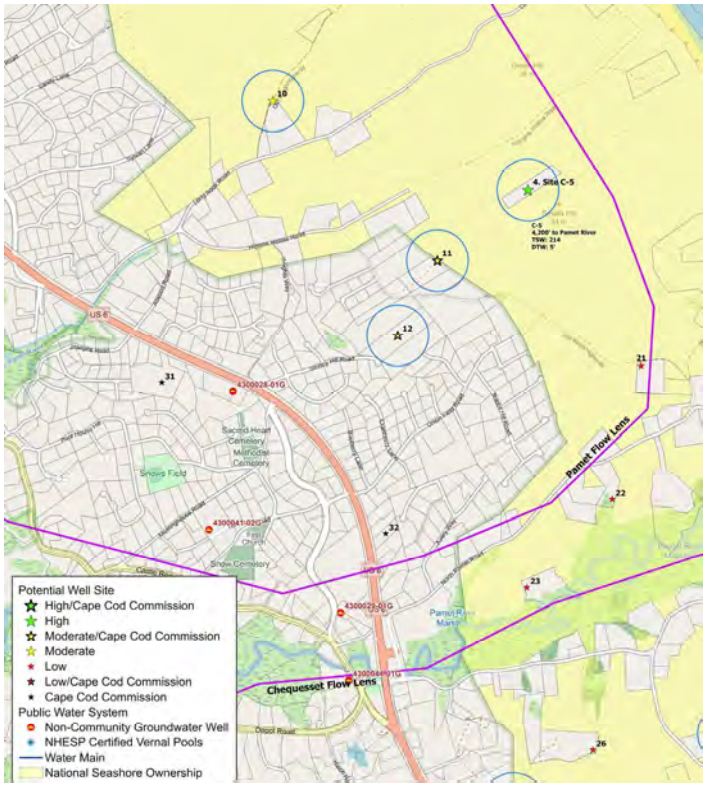
Potential New Source Water Supply Sites

11. North Old Kings Highway

- Privately-owned undeveloped parcels adjacent to National Seashore
- Potential impacts to Little Pamet River
- Need to evaluate potential

12. South Old Kings Highway

- Three privately owned undeveloped parcels (Ree Hill Realty Trust)
- Potential impacts to Little Pamet River



Potential New Source Water Supply Sites

Moderate Priority Well Sites

Site ID Favorability	Parcel ID	Description
7 Moderate (CCC Site)	39_78_0 39_77_0	This parcel was recently sold to Compact of Cape Cod Conservation Trust. There is potential to site a well on the Conservation Trust Parcel and extend the Zone I onto the adjacent parcel to the southwest owned by Truro Conservation Trust. This location is proximal to the coast (~2,000 ft) and edge of Pamet Lens which could result in higher potential for saltwater intrusion. For comparison, Knowles Crossing wellfield is located <1,000 ft from the coast and has an estimated safe yield of 0.2 MGD. It is also proximal to sensitive environmental receptors including Village Pond, vernal pools and wetlands which would need to be assessed. Due to potential impacts to sensitive environmental receptors, this site is ranked as moderate.
8 Moderate	36_171_0	This privately owned parcel is surrounded by National Seashore and other privately owned parcels to the west. It is possible to develop a well on the northeast corner of the parcel but it would require purchase of the entire parcel and an overlap onto the privately owned parcel to the west. It is close to other public water systems for the North Truro Campground.
9 Moderate	37_10_0	This parcel is located west of South Highland Road and is privately owned and surrounded by National Seashore. There is potential to develop a well on the undeveloped western part of the parcel. It is close to the coast and potential for saltwater intrusion would need to be assessed. There are vernal pools nearby.
10 Moderate	43_118_0 43_120_0	The northern part of the parcel appears undeveloped with a structure located on the southern part of the property close to Long Nook Road. The parcel is surrounded by National Seashore to the north. A well could be located greater than 400 feet from the structure on undeveloped land. There is a privately owned parcel to the southwest which would require ownership/easement for the undeveloped portion within the Zone I. However the parcel is in close proximity to Little Pamet River and potential impacts would need to be assessed. Topography of this parcel is highly variable.
11 Moderate (CCC Site)	47_9_0 47_6_0 47_117_0	These privately owned parcels are surrounded by National Seashore to the northeast and other privately owned parcels to the south and west. A well could be developed on the eastern border of the parcel with a Zone I overlapping onto undeveloped areas of the neighboring parcels. It is ranked moderate due to proximity to the Little Pamet River and quantity of parcels required to develop a well.
12 Moderate (CCC Site)	47_121_0 47_122_0 47_142_0	These three undeveloped parcels are south of old kings highway and appear to be subdivisions for potential future development. If available, all three parcels would need to be purchased to secure the necessary area for a Zone I. This location is ranked moderate due to its proximity to the Little Pamet River and potential impacts.
13 Moderate (CCC Site)	51_80_0 51_81_0 51_79_0 51_76_0 51_87_0 PRIV_ROW	These parcels are located in the southern part of Truro and west of RT 6. There is potential to site a well located 400 feet west of RT 6 on parcel 51_80_0 and obtain control/ownership of this parcel and adjacent parcels (6 parcels total) within the Zone I. The National Seashore is south of these parcels and within the potential Zone I. There is a private ROW to the north (Keezer Court) which would need to be obtained and a driveway easement through the conservation property. This location is close to the Pamet River (~2,200 ft) and impacts would need to be assessed. This location is approximately 1,500 feet northwest of the closed Truro Landfill. This location is within the Chequesset flow lens rather than the Pamet flow lens.
14 Moderate	51_61_0	This privately owned parcel is surrounded by National Seashore. There are structures located on the western part of the property by Collins Road. It is possible to develop a well on the eastern part of the property in the undeveloped area. It is ranked low due to proximity to Pamet River and the coast.
15 Moderate	54_92_0	This privately owned parcel is surrounded by national seashore and one other privately owned parcel to the northeast. Structures appear to be located on the north part of the property and it is possible to develop a well on the southern part of the property in the undeveloped area. It is ranked moderate due to its location in the southern part of Truro and feasibility to access this location. An assessor's search notes that this parcel can not be subdivided (no frontage). This location is within the Chequesset flow lens rather than the Pamet flow lens.
16 Moderate	55_20_0	This privately owned parcel is surrounded by the National Seashore. A well could be located greater than 400 feet from the observed structure on undeveloped land. However it is ranked moderate due to its distance in the southern part of Truro and its proximity to a former fuel oil spill site located approx. 1,500 feet to the northeast. This location is within the Chequesset flow lens rather than the Pamet flow lens.

3 Discussion

DRAFT
For Discussion Purposes

Figure 1
Preliminary Assessment of Potential Well Sites
Truro, MA
July 2025

0 1,500 3,000 6,000
Feet

APEX

Preliminary Desktop Assessment for Favorable Well Sites in Truro, MA

Site ID Favorability	Parcel ID	Description
1 High	36_183_0 36_184_0	Two privately owned parcels located south of Highland Road and surrounded by the National Seashore. The existing structures on the parcels appear to be located adjacent to the road. There is potential to site a well on the southern undeveloped part of the parcels farther from Highland Road. This site is high priority due to its distance from the coast and surface water features. A well could be developed greater than 400 feet from existing structures on a portion of the undeveloped land. Potential interference with the South Hollow Wells (~2,000 ft south) would need to be assessed.
2 High	37_20_0	The two NTAFB Wells are owned by the NPS CCNS. The estimated save yield for the wells is 0.57 MGD although CCNS maximum daily limit is 0.33 MGD. These wells have been used by the Town of Provincetown for emergency purposes under a Special Use Permit. Use of these wells would require an agreement with the NPS, which may be difficult to obtain. The NPS Organic Act as amended, 16 USC Section 1a-2e and DO #35 A, places responsibility on the NPS to protect and regulate the use of national parks, including their water resources and NPS water can only be sold or leased to facilitate the administration of a national park.
3 High (CCC Site)	43_3_0 43_225_0 43_28_0 43_2_0 Walsh	This parcel is owned by the Town of Truro, is bordered to the east by CCNS property, and is approximately 1200 feet from NUF and water supply infrastructure. A water supply site on this parcel would require keeping a portion of the "Walsh Property" for Zone I wellhead protection. Preliminary modeling shows pumping at this site could result in additional saltwater upconing and increased sodium and chloride concentrations at the NUF Wellfield. Acquiring the two parcels to the south could enable the well to be moved further from NUF. Pumping this site at a lower pumping rate in combination with another source may be a viable alternative.
4 High (Site C-5)	44_10_0 (Site C5)	This parcel owned by the Town of Truro is located south of Higgins Hollow Road and near Smalls Hill. The parcel is surrounded by National Seashore. The site (C-5) was previously explored including installation of test well and stream piezometers, and groundwater modeling, which indicate a withdrawal at this location would be limited by potential impacts to the Pamet River (~4,200 ft south) and possibly the Little Pamet River (~5,000 ft west).
5 High (CCC Site)	51_91_0	This parcel is owned by the Town of Truro (Land Bank) and located east of RT 6 and southeast of Edgewood Way. There is conservation land to the northeast and the parcel is adjacent to the national seashore and appears to be undeveloped. It is located close to the Pamet River and potential streamflow impacts which would need to be assessed. This parcel is also located approx. 1,000 feet north of the closed Truro Landfill. This location is within the Chequesset flow lens rather than the Pamet flow lens.
6 High	60_1_0	This parcel is located south of Prince Valley Road and owned by the Town of Truro. The parcel is surrounded by National Seashore and access to the parcel would need to be considered. Parcel is 3,000 feet from Great Pond and impacts to pond levels need to be evaluated. It is located on the southern part of Truro and farther from the system but is farther from the coast. This parcel is approx. 2,000 feet south of a former fuel oil spill site. This location is within the Chequesset flow lens rather than the Pamet flow lens.

Preliminary Desktop Assessment for Favorable Well Sites in Truro, MA

Site ID Favorability	Parcel ID	Description
7 Moderate (CCC Site)	39_78_0 39_77_0	This parcel was recently sold to Compact of Cape Cod Conservation Trust. There is potential to site a well on the Conservation Trust Parcel and extend the Zone I onto the adjacent parcel to the southwest owned by Truro Conservation Trust. This location is proximal to the coast (~2,000 ft) and edge of Pamet Lens which could result in higher potential for saltwater intrusion. For comparison, Knowles Crossing wellfield is located <1,000 ft from the coast and has an eximated safe yield of 0.2 MGD. It is also proximal to sensitive environmental receptors including Village Pond, vernal pools and wetlands which would need to be assessed. Due to potential impacts to sensitive environmental receptors, this site is ranked as moderate.
8 Moderate	36_171_0	This privately owned parcel is surrounded by National Seashore and other privately owned parcels to the west. It is possible to develop a well on the northeast corner of the parcel but it would require purchase of the entire parcel and an overlap onto the privately owned parcel to the west. It is close to other public water systems for the North Truro Campground.
9 Moderate	37_10_0	This parcel is located west of South Highland Road and is privately owned and surrounded by National Seashore. There is potential to develop a well on the undeveloped western part of the parcel. It is close to the coast and potential for saltwater intrusion would need to be assessed. There are vernal pools nearby.
10 Moderate	43_118_0 43_120_0	The northern part of the parcel appears undeveloped with a structure located on the southern part of the property close to Long Nook Road. The parcel is surrounded by National Seashore to the north. A well could be located greater than 400 feet from the structure on undeveloped land. There is a privately owned parcel to the southwest which would require ownership/easement for the undeveloped portion within the Zone I. However the parcel is in close proximity to Little Pamet River and potential impacts would need to be assessed. Topography of this parcel is highly variable.
11 Moderate (CCC Site)	47_9_0 47_6_0 47_117_0	These privately owned parcels are surrounded by National Seashore to the northeast and other privately owned parcels to the south and west. A well could be developed on the eastern border of the parcel with a Zone I overlapping onto undeveloped areas of the neighboring parcels. It is ranked moderate due to proximity to the Little Pamet River and quantity of parcels required to develop a well.
12 Moderate (CCC Site)	47_121_0 47_122_0 47_142_0	These three undeveloped parcels are south of old kings highway and appear to be subdivisions for potential future development. If available, all three parcels would need to be purchased to secure the necessary area for a Zone I. This location is ranked moderate due to its proximity to the Little Pamet River and potential impacts.
13 Moderate (CCC Site)	51_80_0 51_81_0 51_79_0 51_76_0 51_87_0 PRIV_ROW	These parcels are located in the southern part of Truro and west of RT 6. There is potential to site a well located 400 feet west of RT 6 on parcel 51_80_0 and obtain control/ownership of this parcel and adjacent parcels (6 parcels total) within the Zone I. The National Seashore is south of these parcels and within the potential Zone I. There is a private ROW to the north (Keezer Court) which would need to be obtained and a driveway easement through the conservation property. This location is close to the Pamet River (~2,200 ft) and impacts would need to be assessed. This location is approximately 1,500 feet northwest of the closed Truro Landfill. This location is within the Chequesset flow lens rather than the Pamet flow lens.
14 Moderate	51_61_0	This privately owned parcel is surrounded by National Seashore. There are structures located on the western part of the property by Collins Road. It is possible to develop a well on the eastern part of the property in the undeveloped area. It is ranked low due to proximity to Pamet River and the coast.
15 Moderate	54_92_0	This privately owned parcel is surrounded by national seashore and one other privately owned parcel to the northeast. Structures appear to be located on the north part of the property and it is possible to develop a well on the southern part of the property in the undeveloped area. It is ranked moderate due to its location in the southern part of Truro and feasibility to access this location. An assessor's search notes that this parcel can not be subdivided (no frontage). This location is within the Chequesset flow lens rather than the Pamet flow lens.
16 Moderate	55_20_0	This privately owned parcel is surrounded by the National Seashore. A well could be located greater than 400 feet from the observed structure on undeveloped land. However it is ranked moderate due to its distance in the southern part of Truro and its proximity to a former fuel oil spill site located approx. 1,500 feet to the northeast. This location is within the Chequesset flow lens rather than the Pamet flow lens.

Preliminary Desktop Assessment for Favorable Well Sites in Truro, MA

Site ID Favorability	Parcel ID	Description
17 Low	33_32_0 Campground	North of Highland Camping Area. Several non-community water systems exist on the eastern part of the parcel. There is potential to site a well in the southwest area of the site which would overlap onto the National Seashore. This would require purchase of part of the undeveloped parcel. Assessors data indicates the parcel is subject to a conservation easement granted to USA 4/2/10 for $2,400,000 per Doc 1137380 (no subdiv allowed + can only be used as campground + for conservation + passive outdoor recreation). It is located closer to the edge of the lens with potential concern for saltwater intrusion.
18 Low	37_4_0 37_3_0 37_1_0 37_2_0	These privately owned parcels are surrounded by National Seashore and three other privately owned parcels. There are structures located on the parcel but a well could be potentially be developed on the northwest corner with a Zone I expanding onto undeveloped areas of the neighboring parcels. It is ranked low due to proximity to the coast and quantity of parcels required to develop a well at this location.
19 Low	39_107_0	This privately owned parcel is used for sand and gravel mining. It is ranked low due to its land use.
20 Low	42_146_0 42_147_0	There are two privately owned parcels located north of Great Hollow Road. Structures appear to be located in the southeast portion of both properties and there is a large area of undeveloped land in the northwest. The combined parcels would have enough space for a well centered in the middle but would require purchase of both parcels. An existing house is within the potential Zone I. The parcels are also close to the coast and the potential for saltwater intrusion would need to be assessed.
21 Low	47_126_0	This privately owned parcel is surrounded by the National Seashore. There are structures located within the property and would require purchase of the entire property to develop a well. It is also close to the coast, vernal pool and Pamet River.
22 Low	47_136_0 47_168_0 47_138_0	Three privately owned parcels are located south of North Pamet Road and surrounded by the National Seashore. A well could potentially be developed on the easternmost parcel but would require purchase/easement of all three parcels. There are wetlands in this area and it is close to the Pamet River.
23 Low	51_16_0	This privately owned parcel is surrounded by the National Seashore. A well developed on this parcel would require purchase of the entire property. The parcel is close to wetlands and the Pamet River.
24 Low	51_57_0	This privately owned property is north of South Pamet Road and is surrounded by National Seashore. There is a structure on the southern part of property, but the parcel extends to the north where a well could be developed greater than 400 feet from the structure on the property. It is ranked low due to wetlands to the north and proximity to Pamet River and the coast.
25 Low	51_60_0	This privately owned parcel is surrounded by the National Seashore. There are structures located within the property and would require purchase of the entire property to develop a well. It is also close to the coast and Pamet River.
26 Low	51_65_0	This privately owned property is south of South Pamet Road and is surrounded by National Seashore. There is a house on the property, but the parcel extends back to the east where a well could be developed greater than 400 feet from the structure on the property. There are structures in the area south of the property but within the national seashore. It is ranked low due to proximity to the Pamet River.
27 Low	59_88_0	This privately owned parcel is surrounded by the National Seashore. A well developed on this parcel would require purchase of the entire property. The parcel is far from the water system.
28 Low	64_11_0	This privately owned parcel is surrounded by the National Seashore. A well developed on this parcel would require purchase of the entire property. The parcel is far from the water system.

Preliminary Desktop Assessment for Favorable Well Sites in Truro, MA

Site ID Favorability	Parcel ID	Description
29 CCC Site	40_127_0 40_128_0 40_129_0 40_130_0 40_155_0 40_156_0 40_157_0 40_158_0	These privately owned parcels are located southeast of South Highland Road and north of Fair Winds Passage. They are all developed as residential lots and are adjacent to the National Seashore to the northeast. This location was identified as a potential future water source by the Cape Cod Commission. However it is unlikely that a new well source could be developed in this location due to the inability to own/control the Zone I area.
30 CCC Site	46_361_0 46_362_0 46_363_0	These privately owned parcels are located west of Castle Road and were identified by Cape Cod Commission as a potential future water supply source. However, the parcels are proximal to the Little Pamet River and public roadways which would limit the ability to own/control the Zone I for a potential new well source.
31 CCC Site	46_375_0 46_374_0 46_213_0	These parcels are located south of RT 6 and were identified by Cape Cod Commission as a potential future water supply source. However, the parcels are proximal to the Little Pamet River and public roadways including RT 6 and Blackfish Road which would limit the ability to own/control the Zone I for a potential new well source. Several other privately owned parcels surrounding these parcels would need to be owned/controlled to devleop a well in this locaiton.
32 CCC Site	47_155_0 47_92_0 47_156_0 47_154_0	These parcels are located east of RT 6 and were identified by Cape Cod Commission as a potential future water supply source. However, the parcels are proximal to the Pamet River and public roadways including RT 6 which would limit the ability to own/control the Zone I for a potential new well source. Several other privately owned parcels surrounding these parcels would need to be owned/controlled to devleop a well in this locaiton.

05-22-2025

Monthly Meeting

Meeting Minutes

Date: May 22, 2025 at 2:00 PM

Location: Microsoft Teams Meeting

Meeting Title: Kickoff Meeting for Regional Water Supply and Watershed Management Study
Town of Provincetown

Prepared By: Lauren Thistle, Hydrogeologist, Apex Companies

Attendants: Cody Salisbury, Water Superintendent, Town of Provincetown
Jim Vincent, Public Works Director, Town of Provincetown
Thaddeus Soule, Town Planner, Town of Provincetown
Timothy Famulare, Community Development Director, Town of Provincetown
Katie Halvorsen, Housing Coordinator, Town of Truro
Emily Beebe, Health & Conservation Agent, Town of Truro
Paul Millett, Sr. Principal & Project Manager, Apex Companies
Ann Marie Petricca, Director of Geosciences, Apex Companies
Sabrina Castaneda, Senior Project Engineer, Apex Companies
Lauren Thistle, Hydrogeologist, Apex Companies

Staff from the Town of Provincetown, Town of Truro, and Apex Companies (Apex) met via Microsoft Teams meeting at the above date and time to discuss the regional water supply study. Apex provided an overview of the scope of services based on the grant application prepared in March/April 2024 through the One Stop Grant Program. Apex presented a brief background of past efforts completed and ongoing tasks for the project. Staff from Provincetown and Truro provided feedback for the next steps of the project.

The topics discussed during the meeting are summarized below.

Project Kickoff and Updated Scope

- The Town of Provincetown was awarded a grant through the One Stop Grant Program from the Massachusetts Executive Office of Economic Development, Rural Programs.
- The scope of work for this study was established based upon the grant application and includes:
    - Assessment of the existing water system
    - Understanding the need for a redundant supply
    - Identifying necessary infrastructure to support housing and job growth
    - Suggested revisions to the framework of the Inter Mutual Agreement (IMA) between Provincetown on Truro

- Key components of the IMA framework were outlined:
  - Conservation Plan & managing Unaccounted for Water (UAW)
  - Watershed Management Plan
  - Water Master Plan with water supply forecasting for the next 20 years and building redundancy into the system
- The study will explore various options because both communities need water and there are several ways that the project can proceed. Collaboration and regular communication will continue in order to develop a plan that can be supported by both communities.
- A brief introduction to Task 1 was discussed. The study will begin with an assessment of historical water supply and demand.

Project Background

Existing Water System

- Apex provided an overview of the existing water system, water supply sources in Truro and Provincetown and hydrogeology of the study area
  - There are three existing well sources that serve the water system
    - Knowles Crossing
    - South Hollow
    - North Union Field (NUF)
  - Additional community groundwater wells not supplying the water system include the North Truro Air Force Base Wells (NTAFB) located within the Cape Cod National Seashore
    - NTAFB Wells are used for emergency situations
    - They were used when the NUF wells were being developed
  - The study will address potential locations for developing another water supply source

Groundwater Modeling

- Apex provided a background of groundwater modeling completed for the Outer Cape and the items associated with Task 2 to create an expanded groundwater model
  - Apex with McLane Environmental (now QHS Consultants) performed groundwater modeling using the USGS MODFLOW and SEAWAT programs for the outer Cape, Provincetown, Truro, and Eastham which can be adjusted as needed for this study
  - The study goal is to create a broader groundwater model for the well systems
  - Conduct model runs with rising sea levels and salinity to evaluate resiliency of the existing system
  - Look at most vulnerable wells
  - Assess drawdown to wetland resources and sensitive environmental receptors

Hydrogeology

- The outer Cape hydrogeology consists of freshwater lenses separated by rivers. These lenses include the Pilgrim Lens in Provincetown, Pamet Lens in Truro, Chequesset Lens in Wellfleet, and the Nauset Lens in Eastham.
  - A depiction of the freshwater/saltwater interface was shown as a cross-section example for the cape area

Groundwater Source Development

- Apex showed a map with the existing groundwater sources located within the study area. The study will focus on an evaluation of the existing sources and considerations for future source development.
    - NTAFB Wells
        - Close to the coast and have been used in the past for emergency services
        - Town of Provincetown maintains NTAFB wells
        - Potentially could be used as a source in the summer when extra capacity is needed
        - Need additional information on water quality at the NTAFB wells.
        - Groundwater modeling would need to performed to evaluate how increased pumping of the NTAFB wells could impact the NUF Wells and potential saltwater upconing or intrusion impacts to the NTAFB wells.
        - Potential sea level rise impacts to water quality at the NTAF Wells also needs to be evaluated.
    - If there are effects from sea level rise, Knowles Crossing could be impacted because historical data shows sodium and chloride concentrations at these wells are sensitive to pumping changes.
    - Apex with McLane Environmental (now QHS Consultants) performed groundwater modeling to evaluate and permit the NUF Wellfield (2011 Model). The NUF Wells came online in 2012 and there has been extensive sampling in the area to monitor water quality related to the freshwater saltwater interface and determine the safe yield for NUF-1 and NUF-2.
    - The 2011 groundwater model was updated in 2018 based on water quality data collected at the NUF observation well network during the first five years of wellfield operation. Using the updated model, Apex recommended pumping NUF-2 at two times the pumping rate of NUF-1.
    - The 2018 groundwater model was re-evaluated in 2023 based on water quality data collected at the NUF observation well network during the second five years of wellfield operation, with NUF-2 pumping at two times the pumping rate of NUF-1. No changes to NUF wellfield operations or to the model were recommended in 2023.
    - Apex showed a figure of the modeled freshwater saltwater interface.
    - Groundwater modeling can be used to evaluate sustainable pumping rates that can be achieved without salinity adversely impacting NUF water quality.
- Apex discussed the results of the groundwater modeling that was performed to evaluate development of a potential new water supply source at the Quail Ridge site.
    - The Quail Ridge site was identified as a potential new source that could supply more water for both towns.
    - Modeling of the Quail Ridge site was performed to evaluate potential pumping impacts to the NUF Wellfield
    - Modeling results indicated that pumping at the Quail Ridge site could result in increased saltwater upconing at the NUF Wells with greater impacts to NUF-2 than NUF-1 because NUF-2 is closer to Quail Ridge.
- The study goal is to look for a new groundwater well source
    - First step is to identify favorable parcels that could support a well source

- Apex has started looking at parcels that would be large enough to support a Zone I (400-foot protective radius around the well) as required by MassDEP for wellhead protection

Discussion and Questions

- Apex opened the meeting for feedback, discussion, and questions.
- Jim Vincent asked about the feasibility of obtaining the goal water supply from one well source or two well sources
  - 350 gallons per minute (gpm) (0.5 million gallons per day (MGD)) is the goal for a new well source or source(s) which drives the number of wells
  - The importance of the Zone I radius and finding the available area of land required for new source development was discussed.
- Priority of developing source redundancy
  - There is currently no source redundancy and, in the summer, all wells are active.
- Evaluate the ability to restore the NTAFB Wells
  - Assess the quantity and quality of the water from the NTAFB Wells
  - May be able to leverage the fact that there was a formal understanding in the past
  - Potential for this to be off the table due to its location within the Cape Cod National Seashore and inability to "mine" federal property and strip a resource
  - Cody Salibsury indicated that there was a legal document about the Memorandum of Understanding (MOU) with the NTAFB well that should be reviewed further.
- A goal of the study will be to evaluate potential impacts from sea level rise under both current conditions and future conditions
  - With additional withdrawals
  - The existing groundwater modeling is set up for this assessment
- Emily Beebe had several questions related to groundwater modeling of the existing wells
  - Does the groundwater model incorporate the watershed or just the Zone II areas? There are many private wells or non-community wells located in the study area. How does the model capture the impacts of non-community water supply wells or privately owned wells (other water users) that exist throughout the town?
    - Apex discussed that as we get closer to finding a new source, we would need to evaluate potential impacts to/from other water sources. At this point in the study, it would be mathematically difficult to add all existing wells to the model.
    - As the study progresses to a site-specific scale, wells in that area would be incorporated into the site model. At this time, they are not incorporated into the town model.
  - Is there a water quantity threshold from other water users that would be a concern?
    - Apex discussed that any water users in close proximity to a proposed new source location would be considered in the future evaluation. It was discussed that water users in the same lens/watershed are also discharging into the lens/watershed.
- NTAFB Wells current condition and potential to use them as a source
  - Cody Salisbury informed the group that the NTAFB Wells are sampled routinely for the Town's knowledge and for emergency use

        - Sampling includes coliform every month
        - There is no current sampling plan for the wells because it is not required
        - Apex suggested adding sampling for sodium and chloride
        - Cody has historical data on conductivity that he can provide
    - NTAFB Well 5 is registered but Well 4 is not
        - If the federal government did agree to more routine usage, we may need a public water supply permit for Well 4? Would this be subject to Water Management Act (WMA) permit?
- Apex outlined the list of tasks provided in the updated scope of work
    - There is an emphasis on collaboration moving forward. Input from the team will be essential as Apex proceeds with the study to ensure that everyone is on the same page.
- The study will evaluate two locations as part of the groundwater model for new source development. Apex asked the group to think about narrowing down to two preferred sites for groundwater modeling.
    - Provide any local knowledge related to town-owned parcels or lots for sale that could be options for a new well site
    - Groundwater modeling will be performed at selected sites to evaluate feasibility for the development of a new well
    - The location C-5 was previously identified as an option
        - Potential impacts to the Little Pamet or Pamet Rivers.
        - The parcel is not large enough to contain Zone I and the park is the abutter
        - Group still wants to move forward with consideration of the Site at C-5
    - Apex will send figures of possible sites for the group to consider for new source exploration
        - Focus on parcels along the edge of the national seashore to be able to use this conserved area for part of the Zone I radius
- The Town of Truro will provide Apex with assessments and projections related to water demand analysis so that Apex understands what is assumed for demand in the service area
- Apex will work with Cody Salisbury on the water demand and buildout for the Town of Provincetown
- The Town of Truro indicated that some residents inquired about discontinuing use of their private wells and connecting them to the water system in the future
    - Some areas have known poor water quality. For example, near Pond Road residents have been impacted by nitrates. This is an area in town where the health department has little data on water quality. People have not reported water quality there.
    - There are no known hot spots for PFAS but there are known areas where septic systems are located in close proximity to wells and are impacting water quality.
    - Tying into the system could be a solution to improve water quality for some areas and would be based on need
    - The Town of Truro could expand the survey area. This will require policy discussions with the board of health and select board. The Town of Truro will explore this and bring more information to the group for the next meeting.

    - Now is the time to look at these options. An online survey could be used to collect data on interest for residents to tie into the system.
- The current status of The Town of Truro wastewater disposal plan
    - GHD is working on the model for wastewater disposal
    - The Town of Truro is working on the wastewater management aspect
    - There is a need to model the Walsh Site and School Site to move any wastewater concept forward. The School Site is in an existing Zone II but outside the zone of contribution. MassDEP needs to be engaged to move anything forward here. There is the potential to look at the layout of Route 6 for possible disposal Sites outside of the Zone II.
- The Town of Truro asked about any benefit to connecting non-community water systems to the municipal water system. Some of the vulnerable wells may benefit from being tied into the system. Many water system owners would likely benefit from tying into the system because of the restrictions imposed on owners from operating the water system. Some facilities that are year-round rather than seasonal would be especially beneficial to tie in.

Conclusions and Next Steps

- The study goal is to identify potential improvements, provide recommendations, and prepare and assessment of costs for the identified options. Develop a plan that the team agrees on.
- The grant is driven by the development of affordable housing. Limited water supply limits affordable housing so this needs to be considered as the end goal.
- Timeline
    - Provide Apex with background information and town growth projections
    - Draft update of Task 1 will be ready by the end of June
    - Apex will provide a modeling scope of work by end of June that would include adding new source sites into the model
- A monthly check-in meeting was established for the group to meet on a monthly basis to discuss findings and the plan forward. The next meeting will be on June 26, 2025 at 2 PM via Microsoft Teams. After this, monthly meetings will be on the third Thursday of each month at 2 PM.

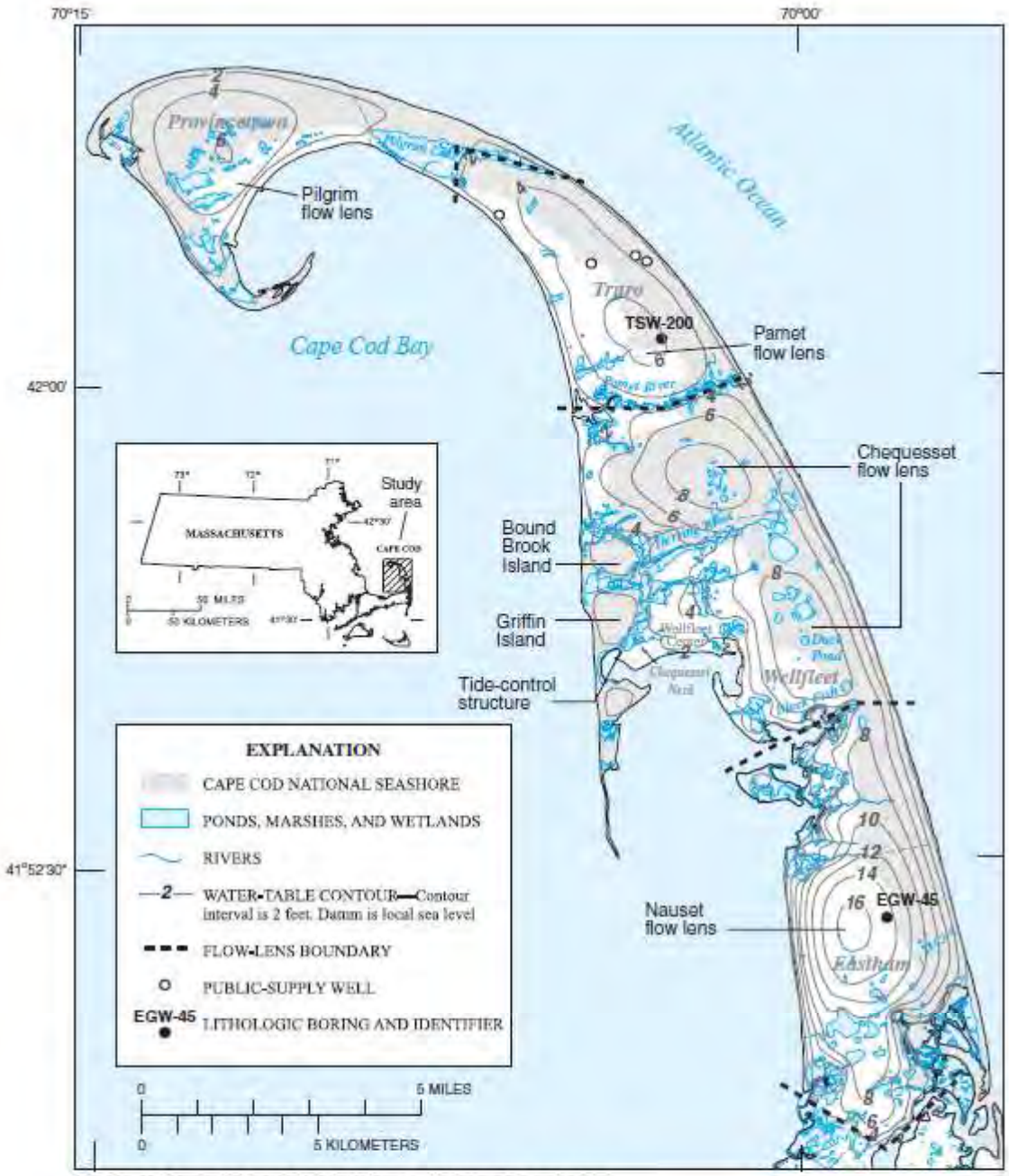
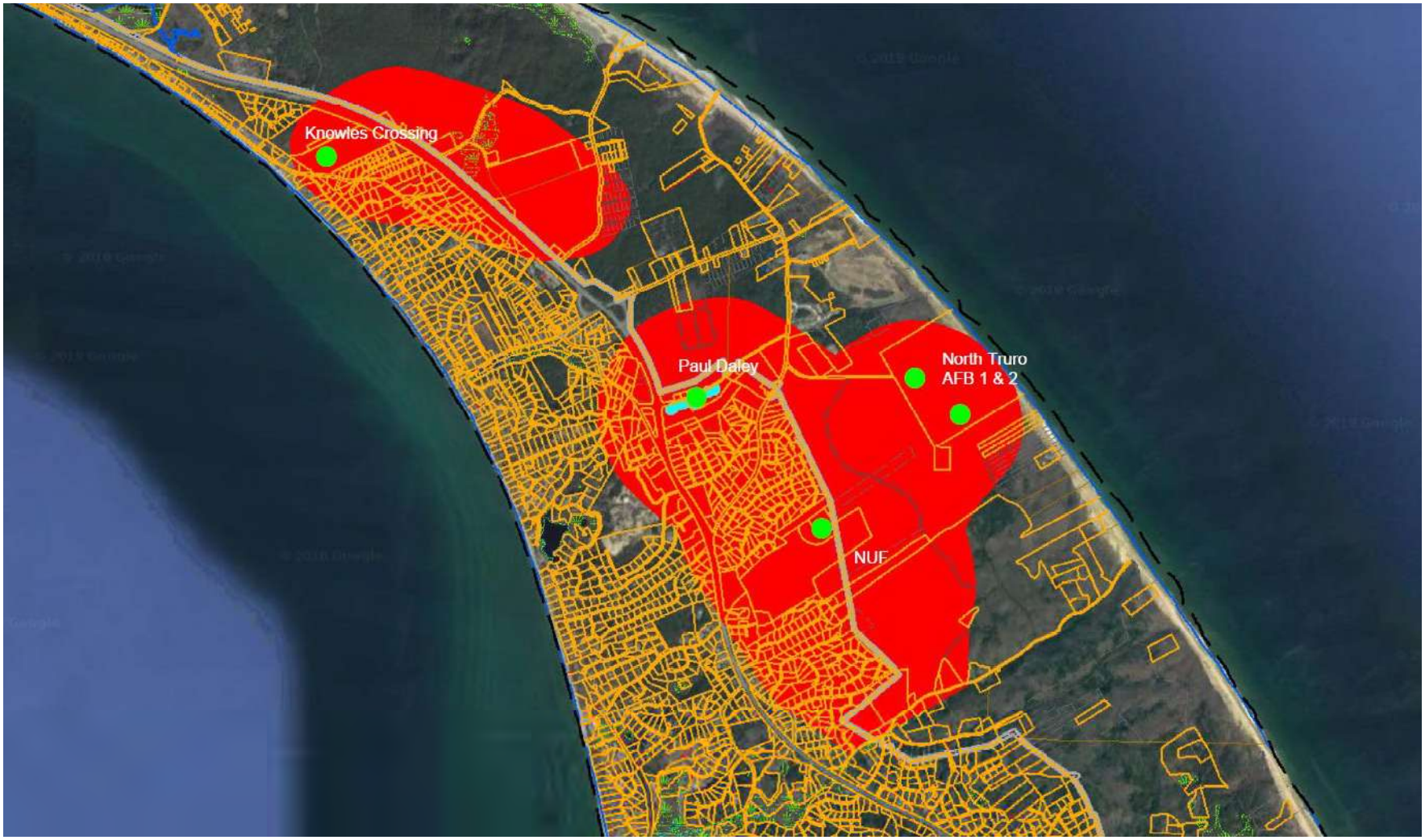
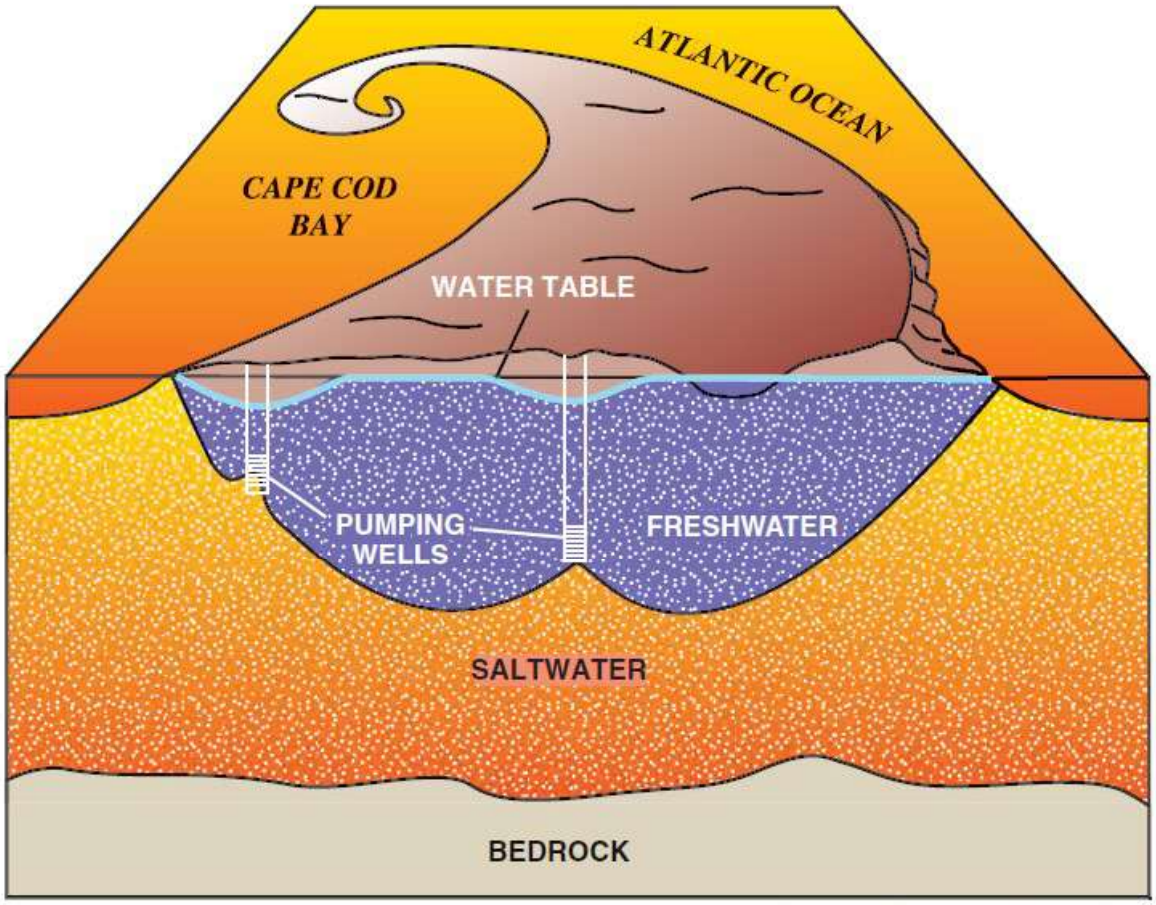


Figure 1. Location of the four flow lenses of the Lower Cape Cod aquifer system and model-calculated water-table contours, Cape Cod, Massachusetts.

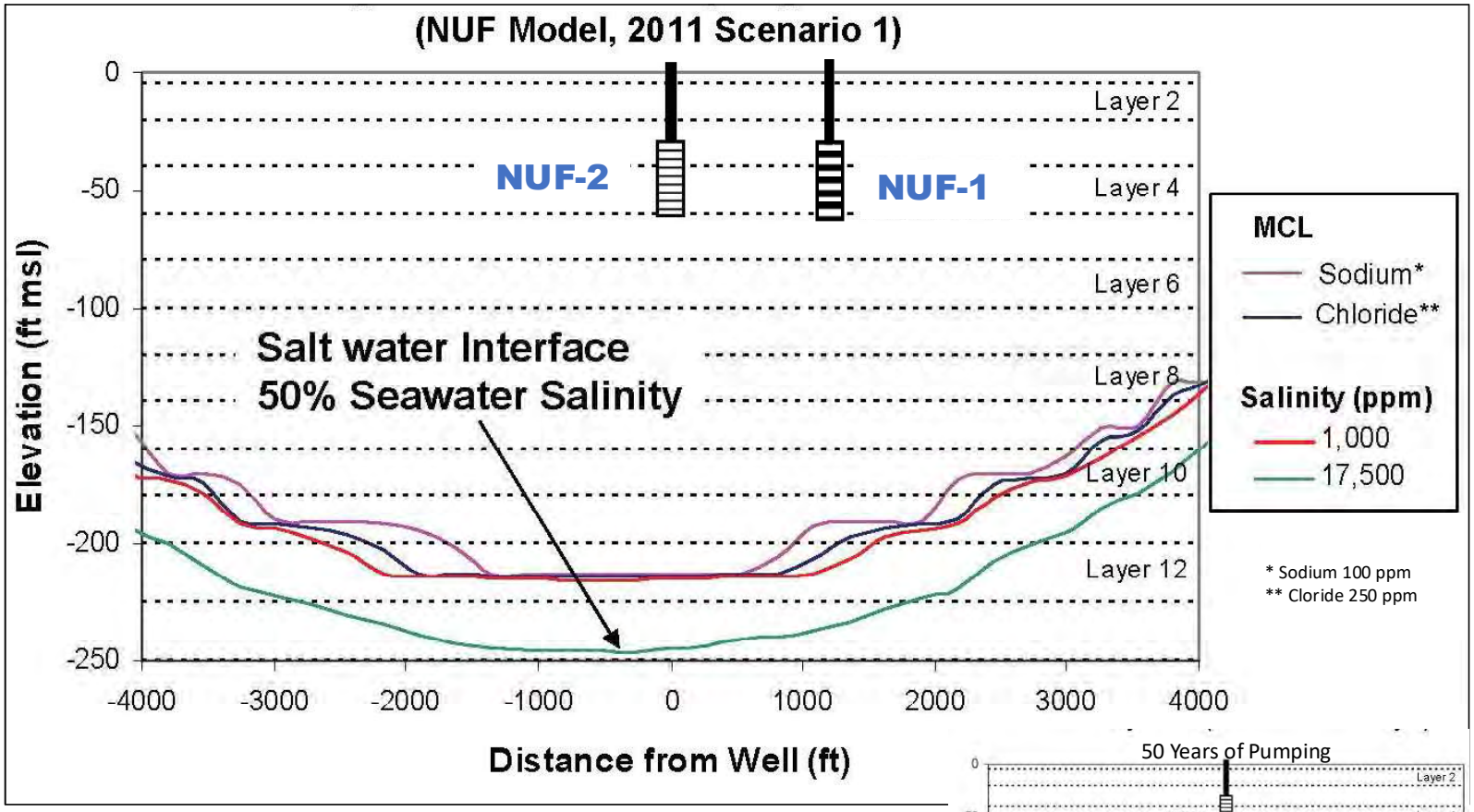
Provincetown-Truro Water Supply Sources

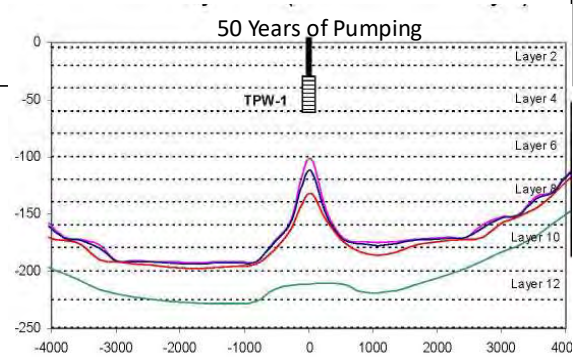

Knowles Crossing
Paul Daley
North Truro
AFB 1 & 2
NUF



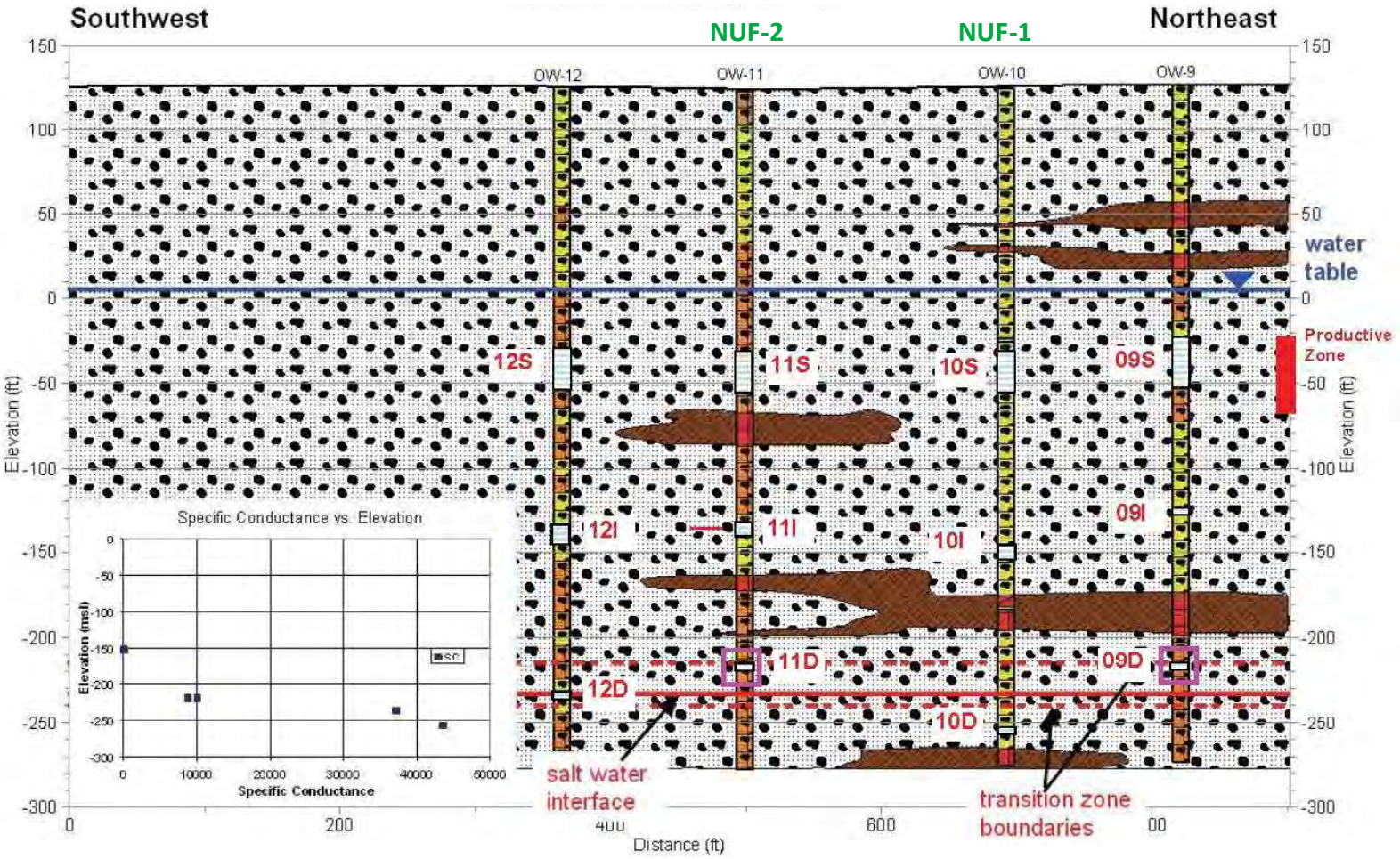
Schematic diagram, not to scale

West East



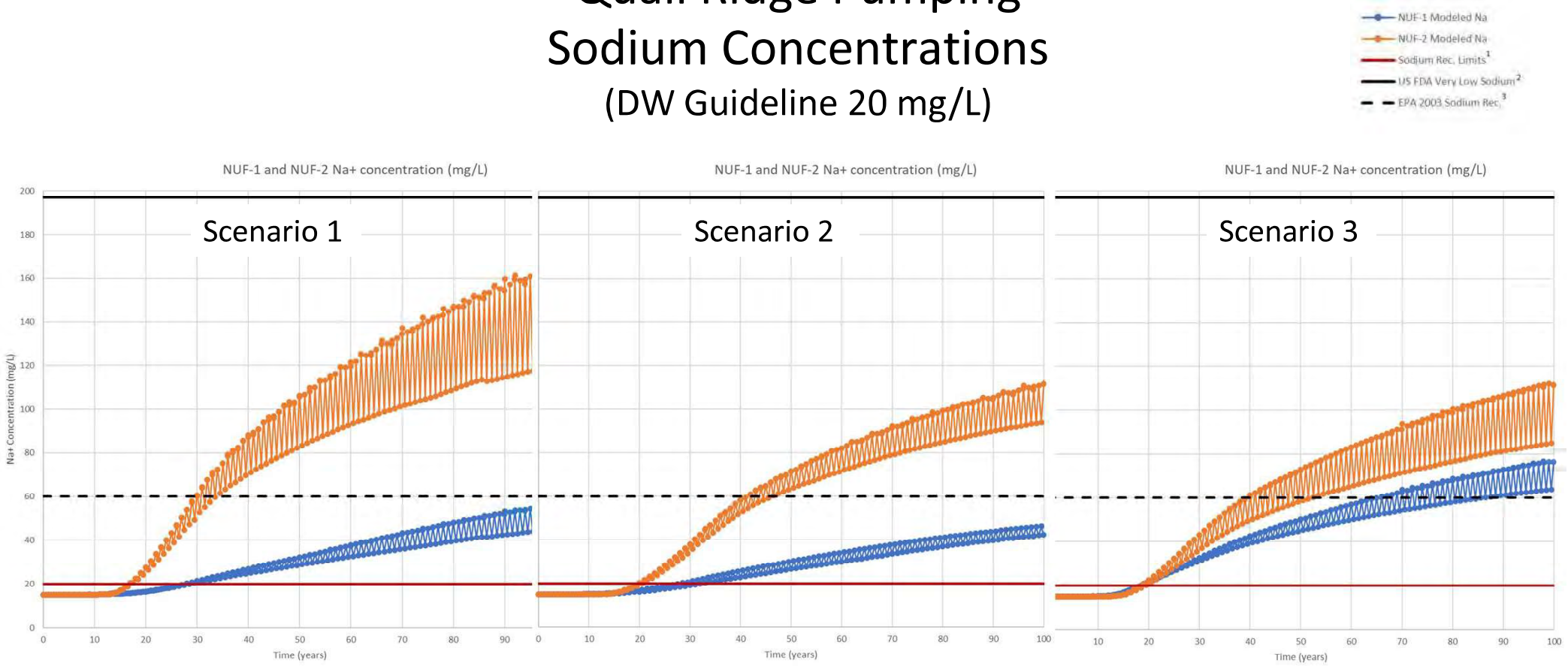


Pre-Pumping Groundwater Conditions with Saltwater Interface



NUF Site Geologic Cross-Section

Quail Ridge Pumping Sodium Concentrations
(DW Guideline 20 mg/L)



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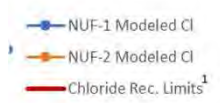
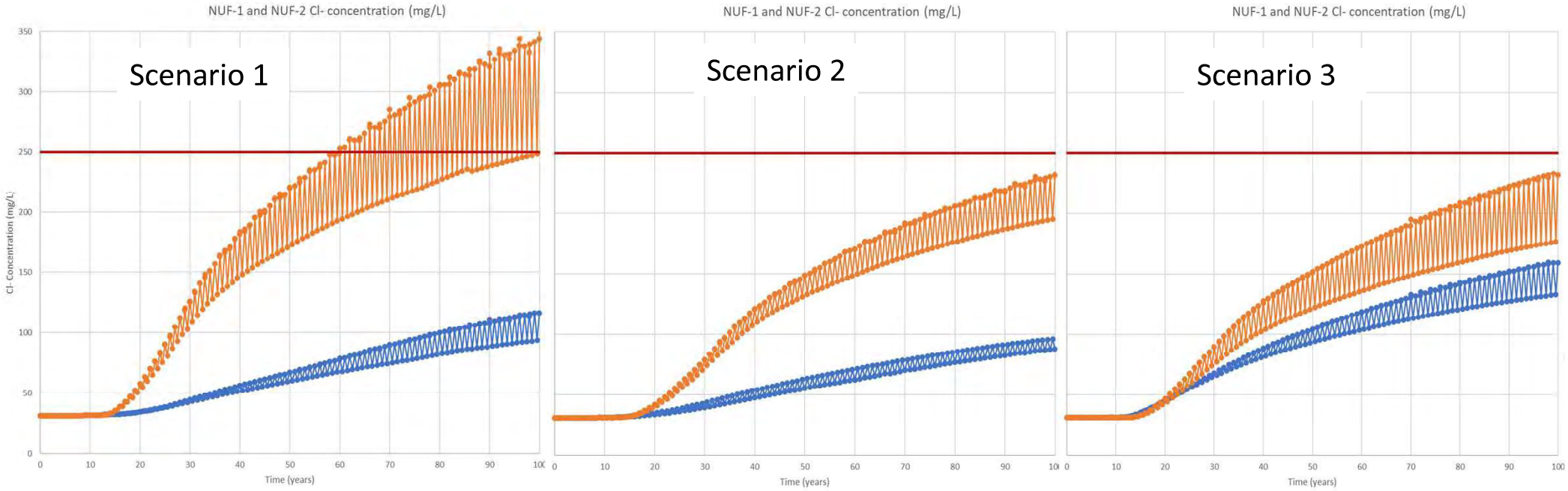
Quail Ridge Pumping Chloride Concentrations
(SMCL 250 mg/L)



1. MassDEP Secondary Maximum Contaminant Level (310 CMR 22.07D) (MassDEP, 2020)



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