ARKADIAH

Datacenter Flood Risk Assessment

Lynnway Park candidate site - Lynn, Massachusetts

Reference location: 42.451233, -70.959742

August 2026

Report Overview

This report assesses how coastal and compound flooding could affect the Lynnway Park datacenter candidate area and its continued operation. Public coastal evidence is kept distinct from Arkadiah's flood simulations.

It is organised in three parts:

1 Public coastal evidence

2 Arkadiah flood simulations

3 Risk evolution in 2030, 2050 and 2070

Contents

ATTRIBUTION GUIDE

Public MC-FRM maps and flood extents are external evidence. Arkadiah produced the SFINCS simulations, the illustrative exposure-testing areas, the comparisons, and the risk interpretation. The report does not attribute work to individual team members.

1 Executive summary

This final assessment examines how coastal and compound flooding could affect a datacenter candidate area and its continued operation. It distinguishes the official public MC-FRM coastal evidence from Arkadiah's simulations and uses approximate shapes only to test how water could affect a building area, external equipment, and access.

Horizon	Exposure across the three sites	Access and isolation risk	Basis
2030	0 Circle 0%; 626 Lynnway 74.9%; 680 Lynnway 37.5%	High	Public 1% annual-chance coastal extent; no Arkadiah 2030 depth simulation
2050	0 Circle 6.4%; 626 and 680 Lynnway 100%	Very high	Public 1% coastal extent plus Arkadiah compound stress test
2070	0 Circle 16.7%; 626 and 680 Lynnway 100%	Very high	Public 1% coastal extent plus Arkadiah compound stress test

HOW RISK CHANGES

2030: public coastal mapping reaches about three quarters of 626 Lynnway and more than one third of 680 Lynnway, while 0 Circle Avenue remains outside the mapped extent. 2050: both Lynnway sites are fully within the public extent and 0 Circle develops edge exposure. 2070: exposure at 0 Circle increases, while both Lynnway sites remain fully within the public extent. Access exposure is substantial throughout the assessment period.

- **2030 main risk**: operational isolation caused by flooding of surrounding approaches, even if the higher building area remains dry in the public coastal map.
- **2050 main risk**: loss of reliable access, with emerging direct exposure under the Arkadiah compound stress test.
- **2070 main risk**: combined access failure, direct inundation, and loss of exposed power or cooling dependencies.
- **Probability**: the public MC-FRM event has a 1% chance of being equaled or exceeded in any year at each stated horizon. A 1% annual chance does not imply that the event occurs only once every 100 years.

2 Evidence and scenario purpose

The assessment uses two distinct evidence streams. Public MC-FRM information describes a 1% annual-chance coastal flood for 2030, 2050, and 2070. Arkadiah simulations explore current coastal flooding, intense rainfall, and compound conditions. The assessment compares the public source with the Arkadiah model while keeping their outputs separate.

Scenario	Why it was created	How it is used
December 2022 historical coastal run	Check the coastal and compound workflow against an observed event	Method check only; calibration was not undertaken
July 2023 historical rainfall run	Check the rainfall pathway against an observed event	Method check only; calibration was not undertaken
131.6 mm design-rain run	Isolate sensitivity to an intense short rainfall input	Drainage and surface-water screening
Current coastal screening run	Establish a nominal present-day coastal baseline	Compare present coastal pathways with future tests
Current compound stress test	Combine current coastal level, intense rainfall, and river flow	Explore interacting pathways; no joint annual chance is assigned
2050 compound stress test	Test a mid-life higher coastal level with the same intense rainfall assumptions	2050 sensitivity assessment; no probability forecast
2070 compound stress test	Test a later-life higher coastal level with the same intense rainfall assumptions	2070 sensitivity assessment; no probability forecast

PROBABILITY BOUNDARY

The public MC-FRM coastal maps have a defined 1% annual exceedance probability. Arkadiah's current coastal run uses the 14.0 ft NAVD88 FEMA base flood elevation as a simplified boundary level. The model is not a regulatory flood determination. The compound runs have no calculated joint annual chance, and none of the scenario levels is a recommended construction elevation.

3 Public MC-FRM evidence: 2030, 2050, and 2070

MC-FRM is an external Massachusetts coastal flood model. The three panels below show the estimated area reached by a coastal flood with a 1% chance in a given year under 2030, 2050, and 2070 climate conditions. The same annual chance is shown at each horizon; the mapped area changes because sea level and coastal conditions change.

FEMA FIRM panel 25009C0529G, effective 16 July 2014, maps part of the parcel and its western approaches as Zone AE with a base flood elevation of 14.0 ft NAVD88 (4.267 m). The remainder is shown as unshaded Zone X, outside the mapped 0.2% annual-chance floodplain. FEMA mapping provides regulatory context; it does not supply a parcel-wide 0.2% depth surface for this assessment.

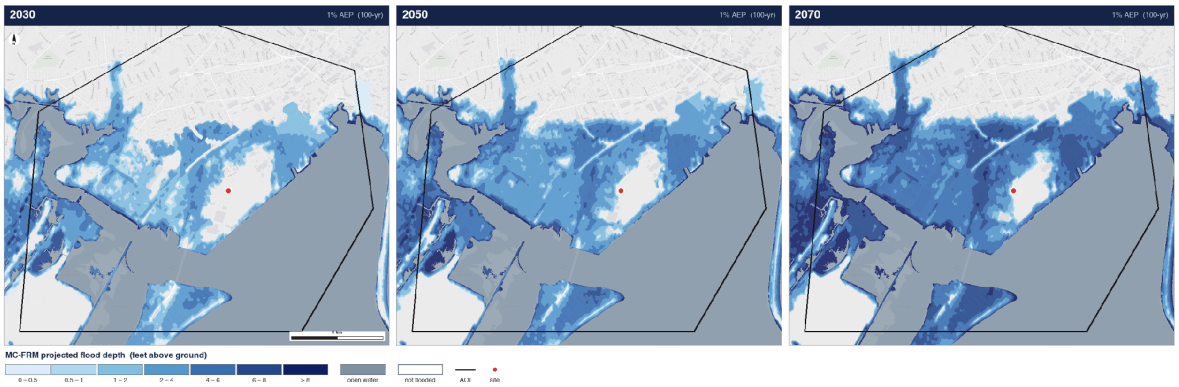


Figure 1. MC-FRM visualization for the 1% annual-chance coastal flood in 2030, 2050, and 2070. Source: Massachusetts Coast Flood Risk Model. The red point marks the project reference location.

The public visualization shows a relatively higher area around the project reference location remaining outside the displayed floodwater while the surrounding flooded area expands and deepens from 2030 to 2070. A dry point does not demonstrate that access, utilities, or the whole operating area remain functional.

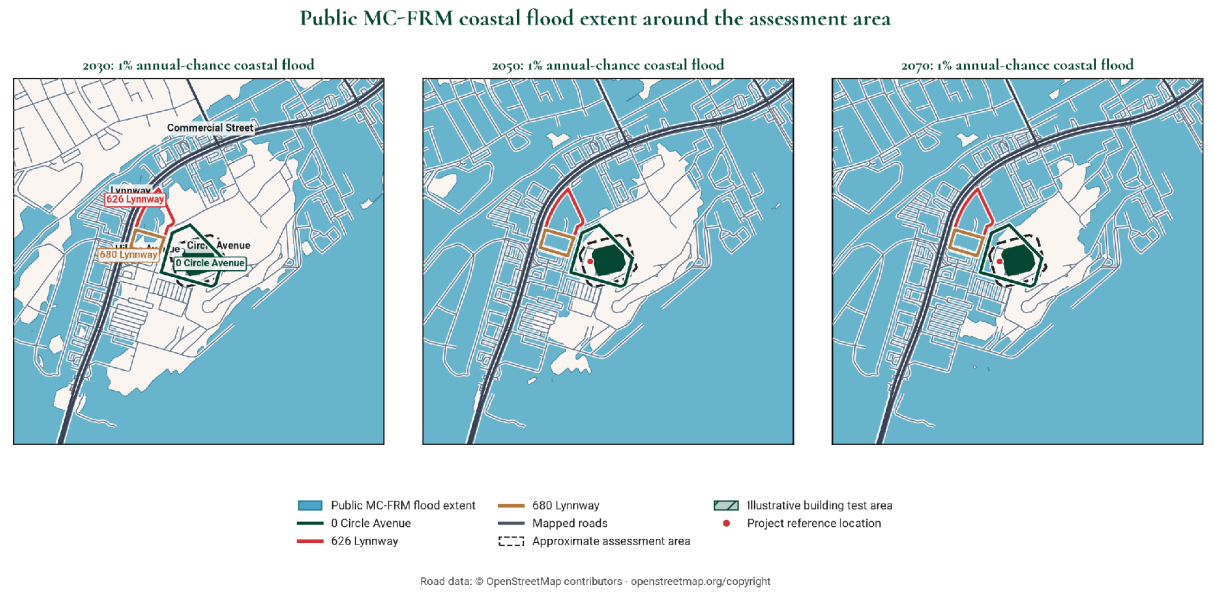


Figure 2. MC-FRM 1% annual-chance coastal flood extent, the three public parcel screening boundaries, and assessment areas. Sources: Massachusetts Coast Flood Risk Model; MassGIS Property Tax Parcels; © OpenStreetMap contributors.

Horizon	Building test area	Road centerline within flood extent	Interpretation
2030	Outside; nearest floodwater about 124 m	Circle 0%; Hilton 79%; Lynnway 95%; Commercial context 33%	Direct coastal exposure is limited, but two documented access roads are already affected
2050	Outside; nearest floodwater about 61 m	Circle 64%; Hilton 100%; Lynnway 97%; Commercial context 65%	Road access becomes the clearest public-source exposure
2070	Outside; nearest floodwater about 34 m	Circle 96%; Hilton 100%; Lynnway nearly 100%; Commercial context 85%	The building margin narrows while the surrounding road network is extensively exposed

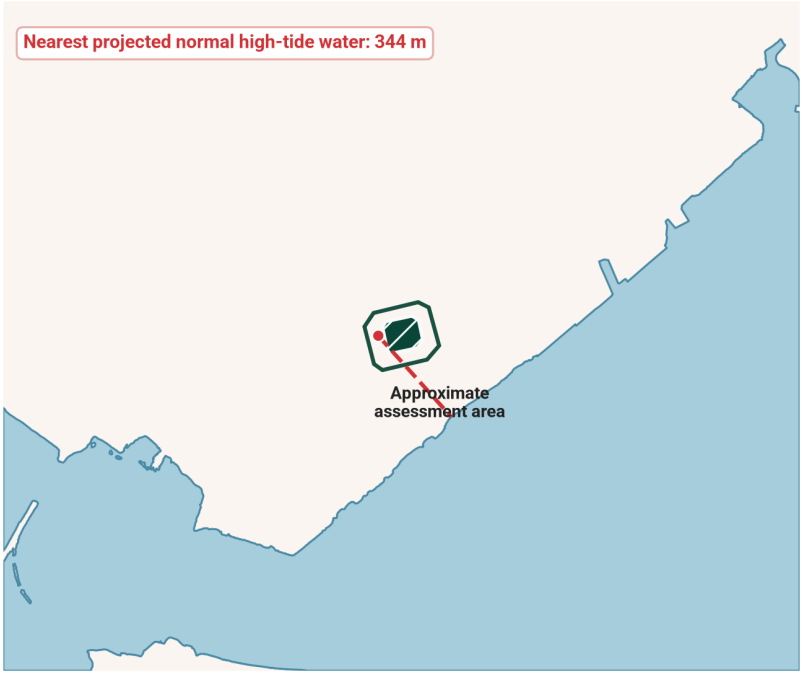
WHY CIRCLE AVENUE DIFFERS BETWEEN SOURCES

The 2030 MC-FRM extent stops about 24 m from the assessed Circle Avenue centerline, while FEMA maps the site-side approach in Zone AE and Arkadiah's simplified current coastal run inundates the road corridor. These results use different terrain treatment, boundary conditions, resolution, and regulatory or planning purposes. The risk assessment therefore treats Circle Avenue as a credible exposure pathway rather than relying on the apparently dry 2030 MC-FRM centerline alone.

The separate 2030 normal high-tide shoreline file places the nearest projected normal high-tide water about 344 m from the project reference location. The file describes ordinary tidal conditions and provides contextual information only. Storm-flood risk is assessed separately.

Where the normal 2030 high-tide shoreline is projected

Public MC-FRM estimate of the normal high-tide waterline. Storm-flood extent is outside the scope of this map.



Supplementary map. Projected 2030 normal high-tide shoreline context. The map depicts the estimated shoreline during ordinary high tide; storm-flood extent is outside its scope. Source: Woods Hole Group MC-FRM.

4 Arkadiah flood simulations

Arkadiah created seven SFINCS simulations to separate coastal, rainfall, river, and compound flood pathways. The historical runs test whether the workflow responds plausibly to observed conditions. The synthetic runs hold most assumptions constant while changing the driver of interest, so differences between scenarios can be interpreted consistently.

Common model setup

- **Terrain and grid.** The 2021 MassGIS 0.5 m bare-earth terrain was averaged to a 20 m SFINCS grid in NAD83(2011) / UTM Zone 19N. The 20 m grid supports site-wide screening. Detailed road or building design requires finer-resolution analysis.
- **Surface resistance.** Manning roughness was 0.045 s/m^(1/3) on land and 0.022 s/m^(1/3) below 0.5 m elevation. These values represent generalized land and open-water resistance.
- **Rainfall and infiltration.** Rainfall was applied uniformly across the model. A constant 2 mm/hour infiltration rate represented generalized losses because mapped soils and drainage were not available. This rate does not distinguish pavement, permeable ground, or the known capped former-landfill areas and may understate runoff from low-permeability surfaces.
- **Coast and river.** Coastal water level was applied along the southern model boundary. River flow entered through one source point near the Saugus River. The design forcings were supplied at 15-minute intervals.
- **Run controls.** Synthetic scenarios ran for 24 hours, with a maximum calculation step of 60 seconds, depth-map output every 30 minutes, and an overall maximum-depth field retained for each run.

How the synthetic inputs were formed

The coastal input combines a tide-like 12.42-hour cycle with a six-hour triangular surge centered at hour 12 and scaled to the stated peak. The 131.6 mm design-rain total is distributed across nine 45-minute blocks (6.75 hours), with the heaviest block near the center. The river input rises from a 1 m^3/s base to its stated peak at hour 14 and falls over a ten-hour triangular window. The timing deliberately overlaps the three drivers in the compound tests.

Scenario	Rain (mm)	Coast peak (m NAVD88)	River peak (m^3/s)	Purpose and parameter basis
December 2022 historical	29.97 record-based	2.581 record-based	2.407 record-based	48-hour method check using archived tide, regional hourly rainfall, and river-flow records
July 2023 historical	44.58 record-based	1.801 record-based	5.635 record-based	24-hour method check focused on rainfall and surface-water response

Scenario	Rain (mm)	Coast peak (m NAVD88)	River peak (m^3/s)	Purpose and parameter basis
131.6 mm design rain	131.6	1.500	8.0	Applies a nominal 1% annual-chance six-hour rainfall depth over the model's 6.75-hour block pattern
Current coastal screen	0	4.267	2.0	Uses the FEMA 14.0 ft BFE as a simplified model boundary; it is not a regulatory reconstruction
Current compound stress test	131.6	4.267	12.0	Tests overlap of the current coastal baseline, intense rain, and high river flow
2050 compound stress test	131.6	5.029	12.0	Adds 0.762 m to the current coastal level while holding rain and river inputs constant
2070 compound stress test	131.6	5.578	12.0	Adds 1.311 m to the current coastal level while holding rain and river inputs constant

Record-based historical values are processed inputs derived from monitoring-station time series; they are not SFINCS outputs or measurements taken at the project location.

WHY THESE ARE STRESS TESTS

The 2050 and 2070 coastal increments are sensitivity assumptions used to show how the same site responds as coastal level rises. The 131.6 mm design-rain total and 12 m^3/s river peak are held constant to isolate that change. Their combined annual probability was not calculated.

When the model shows near-river overbank flooding

The table reports elapsed time from the start of each 24-hour simulation. The prescribed river inflow remains at its 1 m^3/s base through 09:00; its first 15-minute input above base is 09:15, it reaches its peak at 14:00, and it returns to base at 19:00. A near-river overbank indicator is active when at least 5% of the active landside model cells within 300 m of the river source point, and above 0.5 m NAVD88 terrain elevation, exceed 0.30 m modeled depth. Depth output is available every 30 minutes.

Scenario	River input: rise, peak, return	Saved outputs meeting near-river indicator	Peak landside area deeper than 0.30 m
Current coastal screen	09:15-19:00; peak 2.0 m^3/s at 14:00	10:30-15:00; 16:00-18:30	76% at 12:30
Current compound stress test	09:15-19:00; peak 12.0 m^3/s at 14:00	10:30-15:00; 16:00-18:30	76% at 12:30
2050 compound stress test	09:15-19:00; peak 12.0 m^3/s at 14:00	10:30-18:30	81% at 12:00

Scenario	River input: rise, peak, return	Saved outputs meeting near-river indicator	Peak landside area deeper than 0.30 m
2070 compound stress test	09:15-19:00; peak 12.0 m^3/s at 14:00	10:00-18:30	85% at 12:00

The current cases briefly fall below the indicator criterion between two water-level pulses. Each interval runs from the first to the last consecutive 30-minute saved output meeting the criterion; the actual threshold crossing occurs between adjacent outputs. The 0.30 m depth and 5% area requirements avoid treating trace wetting or one isolated grid cell as overflow. Surveyed bank-crest data and source-separation modelling would be required to identify a physical river-only overtopping time, because tide, surge, rainfall, and river flow interact in the estuarine reach. The public 2030 MC-FRM extent has no event hydrograph and therefore supplies no river-overflow timing.

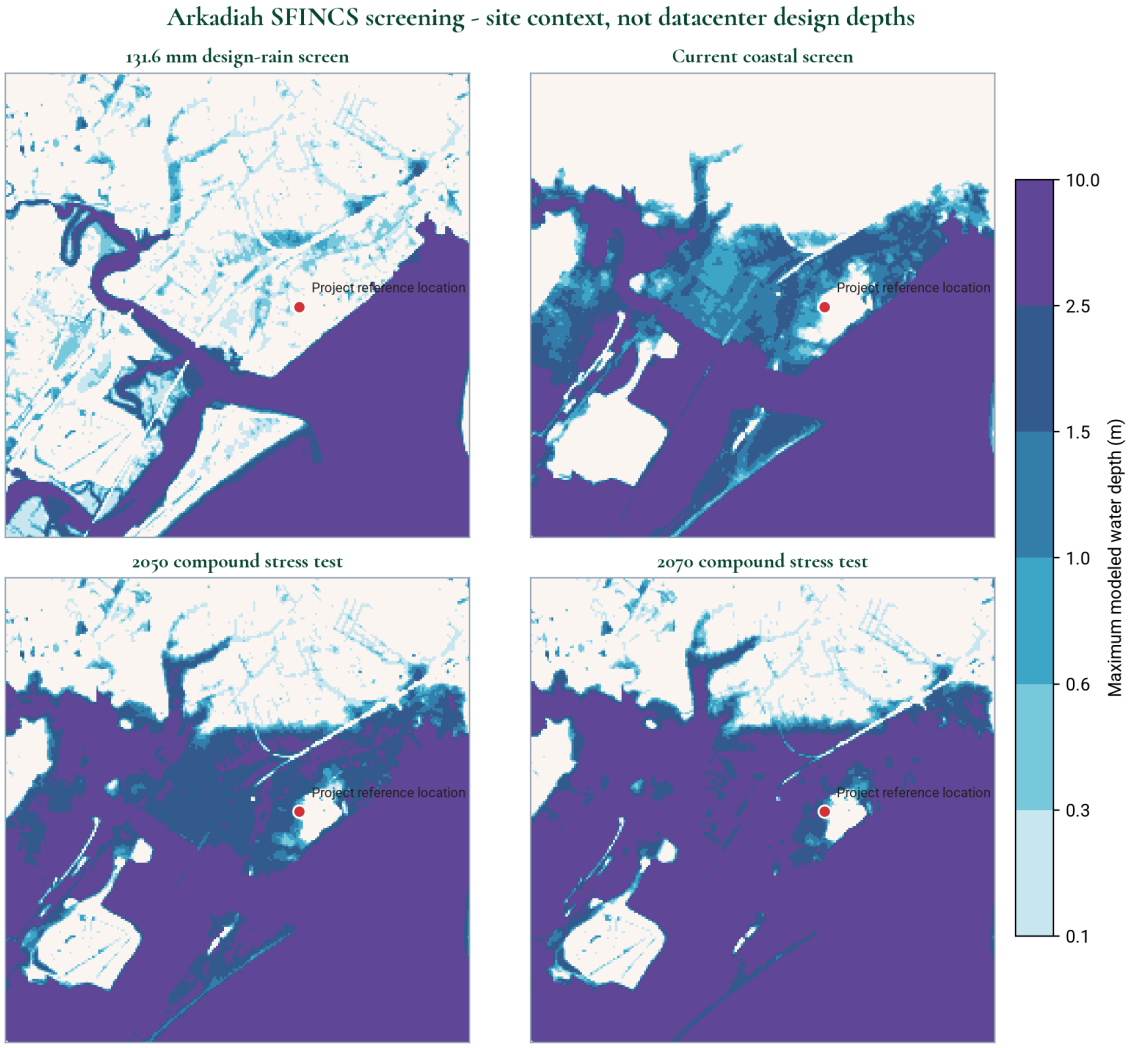


Figure 3. Arkadiah SFINCS scenario maps. The red point marks the project reference location. White areas are below the 0.10 m display threshold. Results represent existing ground conditions.

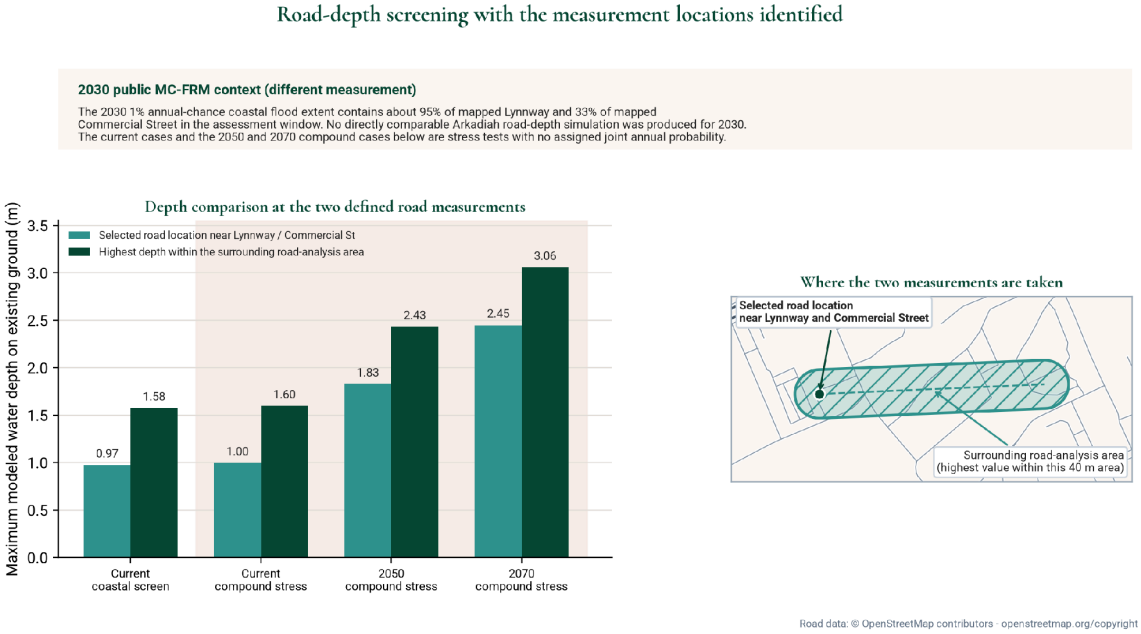


Figure 4. Arkadiah road-depth screening at two defined measurement areas. The map identifies the single selected road location and the surrounding road-analysis area. The 2030 public evidence is reported separately because it does not provide a directly comparable Arkadiah depth value.

At the selected road location near Lynnway and Commercial Street, modeled depth is 0.97 m in the current 1% coastal run, 1.00 m in the current compound run, 1.83 m in the 2050 compound stress test, and 2.45 m in the 2070 compound stress test. The highest values found within the surrounding road-analysis area are 1.58 m, 1.60 m, 2.43 m, and 3.06 m, respectively. These screening values apply to mapped measurement areas on existing ground. They do not represent continuous depths along an entire access route or depths at the datacenter. The compound runs have no assigned annual probability.

5 Exposure of the three assessment sites and site elements

The comparison uses the public MassGIS parcel screening boundaries for 0 Circle Avenue, 626 Lynnway, and 680 Lynnway. These fixed boundaries make the three locations directly comparable; they are public assessment geometry rather than surveyed property boundaries. Circle Avenue, Hilton Avenue, and Lynnway are assessed as documented access roads. Commercial Street is retained as surrounding-network context. Road geometry is drawn from OpenStreetMap.

Three-site comparison

Site	2030 public MC-FRM	2050 public extent / Arkadiah stress test	2070 public extent / Arkadiah stress test
0 Circle Avenue	0.0%; nearest extent 47 m	6.4% of parcel; 43.6% over 0.10 m; P90 0.95 m	16.7% of parcel; 60.4% over 0.10 m; P90 1.58 m
626 Lynnway	74.9% of parcel	100.0% of parcel; 100.0% over 0.10 m; P90 2.70 m	100.0% of parcel; 100.0% over 0.10 m; P90 3.34 m
680 Lynnway	37.5% of parcel	100.0% of parcel; 100.0% over 0.10 m; P90 2.29 m	100.0% of parcel; 100.0% over 0.10 m; P90 2.93 m

Public percentages show the share of each parcel screening boundary within the MC-FRM 1% annual-chance coastal extent. Arkadiah percentages show the share of the same parcel with modeled depth greater than 0.10 m; P90 is the discrete nearest-rank 90th-percentile depth over the fixed 20 m grid, with dry active cells retained as zero. MC-FRM supplies extent rather than depth.

Site	Current coastal screen	Current compound stress test
0 Circle Avenue	7.9% over 0.10 m; P90 0.06 m; max 0.70 m	9.9% over 0.10 m; P90 0.10 m; max 0.72 m
626 Lynnway	100.0% over 0.10 m; P90 1.82 m; max 2.15 m	100.0% over 0.10 m; P90 1.84 m; max 2.17 m
680 Lynnway	100.0% over 0.10 m; P90 1.40 m; max 1.79 m	100.0% over 0.10 m; P90 1.43 m; max 1.81 m

The present-day Arkadiah coastal screen and the public 2030 MC-FRM result are complementary screens with different boundary conditions, terrain treatment, and resolution. At 0 Circle Avenue, the Arkadiah current run shows localized shallow cells while the public 2030 extent remains 47 m from the parcel boundary.

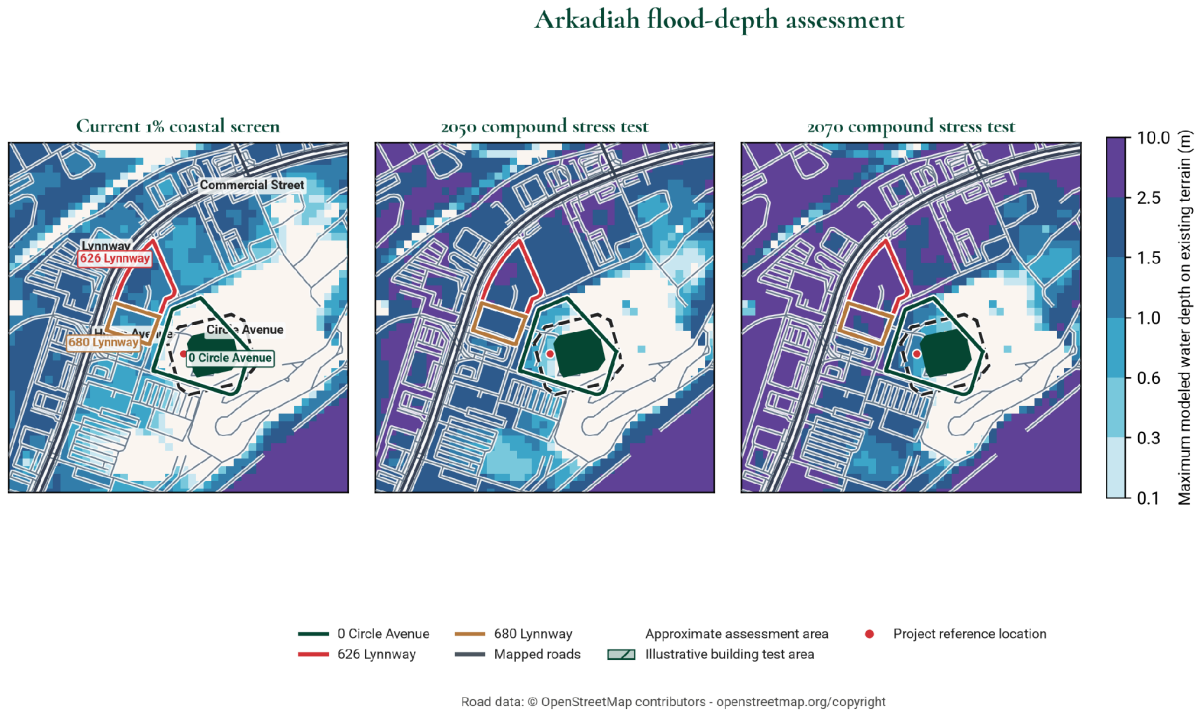


Figure 5. Arkadiah flood-depth assessment with the three MassGIS parcel screening boundaries. Road source: © OpenStreetMap contributors. The 2050 and 2070 panels are compound stress tests.

Illustrative building and access elements

Scenario	Building maximum / area deeper than 0.10 m	Circle Ave P90 (m)	Hilton Ave P90 (m)	Lynnway P90 (m)
Current coastal screen	0.00 m / 0.0%	1.25	1.79	1.88
2050 compound stress test	0.25 m / 10.3%	2.13	2.68	2.73
2070 compound stress test	0.89 m / 34.5%	2.76	3.32	3.35

Road values use the discrete nearest-rank 90th-percentile modeled depth within screening-width areas around the mapped centerlines. Every scenario uses the same geometry denominator, with dry active cells counted as zero. This keeps percentages and percentiles directly comparable between scenarios.

Lidar-derived ground-elevation context

Site parcel	20 m cells	P10 (ft NAVD88)	Median (ft NAVD88)	P90 (ft NAVD88)
0 Circle Avenue	101	13.9	17.4	22.9
626 Lynnway	45	8.2	9.4	10.4
680 Lynnway	23	9.5	10.5	11.0

The three rows above summarize bare-earth ground elevation across each MassGIS parcel screening boundary. They do not describe an exact building footprint, roof, pad, or finished-floor elevation.

Illustrative test area and road elevations

Other assessment element	20 m cells	P10 (ft NAVD88)	Median (ft NAVD88)	P90 (ft NAVD88)
Illustrative building test area (within 0 Circle Avenue)	29	17.0	19.8	21.7
Broader assessment area	90	15.3	19.6	25.4
Circle Avenue	16	10.2	11.0	13.0
Hilton Avenue	5	8.4	9.8	10.8
Lynnway	193	8.2	9.1	10.1

The illustrative building test area is one combined planning-level sampling area located wholly within the 0 Circle Avenue parcel; it does not represent three separate buildings. All values are statistics from lidar-derived terrain averaged to the model's 20 m grid. Road rows are screening context rather than surveyed road-crown elevations. Hilton Avenue is represented by only five model cells, so its values are especially approximate.

Modeled road-exposure duration

Scenario	Circle Avenue (h)	Hilton Avenue (h)	Lynnway (h)
Current coastal screen	1.2	at least 12.4	at least 12.4
2050 compound stress test	2.1	at least 12.9	at least 12.9
2070 compound stress test	2.8	at least 13.0	at least 13.0

Hours show when the road-corridor nearest-rank P90 depth exceeds 0.30 m during each 24-hour run. The 0.30 m value is used as a screening threshold; vehicle impassability is not determined. 'At least' means the threshold was still exceeded at the final output, so the 24-hour run truncates the duration. No comparable Arkadiah duration is available for the public 2030 scenario.

6 Risk evolution by horizon

The following ratings are Arkadiah's qualitative interpretation of the stated evidence. Low, Medium, High, and Very high express relative consequence and exposure for each horizon. Numerical probability is reported separately where available.

Risk pathway	2030 assessment	2050 assessment	2070 assessment
Three-site parcel exposure	High at 626 Lynnway (74.9% in public extent); Medium at 680 Lynnway (37.5%); Low at 0 Circle (0%)	Very high at 626 and 680 Lynnway (100% in public extent and model); Medium at 0 Circle (6.4% public; 43.6% model over 0.10 m)	Very high at 626 and 680 Lynnway (100% in public extent and model); High at 0 Circle (16.7% public; 60.4% model over 0.10 m)
Illustrative building-area inundation	Low: outside public 1% coastal extent; no Arkadiah 2030 depth run	Medium: public extent remains outside, but compound test reaches 10.3%	High: public margin narrows to about 34 m; compound test reaches 34.5% and 0.89 m
Access and isolation	High: public extent reaches about 79% of Hilton Avenue and 95% of Lynnway; Circle Avenue is outside that extent but remains a credible FEMA/model exposure pathway	Very high: public extent reaches about 64% of Circle Avenue, all Hilton Avenue, and 97% of Lynnway	Very high: public extent reaches about 96% of Circle Avenue and essentially all Hilton Avenue and Lynnway
Power and external equipment	Medium - uncertain: equipment locations and utility routes are not defined	Medium to high: road and site-edge exposure raises interruption risk	High: extensive road and direct-site exposure threatens external systems and deliveries
Cooling and communications	Medium - uncertain: dependencies may cross lower ground	Medium to high: route and utility interruption becomes credible	High: widespread access and external-system exposure threatens continuity
Rainfall and drainage	Medium - uncertain: no 2030 rainfall projection or drainage network; uniform infiltration does not represent the landfill cap	Medium - uncertain: the same drainage and infiltration limitations apply	Medium - uncertain: the same limitations remain under higher coastal tailwater

EXPECTED CHANCE OF THE MAPPED COASTAL EVENT

At each of 2030, 2050, and 2070, the public event has a 1% chance in a given year. Assuming a constant independent 1% annual chance, the chance of at least one such event over 30 years is about 26%. The 2050 and 2070 Arkadiah compound stress tests have no assigned annual chance.

7 Main risks to the building and operations

- **2030 - unequal site exposure and operational isolation**. Public coastal mapping reaches 74.9% of 626 Lynnway and 37.5% of 680 Lynnway, while 0 Circle Avenue remains outside the extent. Flooding of surrounding low approaches can still delay staff, emergency services, fuel, and repair crews serving any of the three sites.
- **2050 - widespread Lynnway exposure and emerging Circle Avenue exposure**. Both Lynnway parcels are fully within the public extent and entirely deeper than 0.10 m in the Arkadiah stress test. At 0 Circle, public edge exposure reaches 6.4% and the Arkadiah stress test exceeds 0.10 m across 43.6% of the parcel.
- **2070 - combined site and operational exposure**. Both Lynnway parcels remain fully exposed in both evidence streams. At 0 Circle, the public share rises to 16.7% and the Arkadiah stress test exceeds 0.10 m across 60.4% of the parcel. Power, cooling, communications, and safe access may fail even where a future building floor remains dry.
- **2030, 2050, and 2070 - drainage uncertainty**. The model does not include a surveyed pipe network, pumps, tide gates, small barriers, or final grading. Local ponding and backflow risk therefore remain uncertain at all three horizons.
- **2030, 2050, and 2070 - capped-landfill uncertainty**. Public MassDEP records identify capped former-landfill areas at Lynnway Park. Applying one infiltration rate across the model does not reproduce the cap, pavement, or engineered drainage and may understate runoff from low-permeability surfaces.

Operational dependency	2030 effect	2050 effect	2070 effect
Staff and emergency access	Potential delay or isolation on lower approaches	Serious route disruption under the assessed coastal and compound conditions	Severe route disruption in both evidence streams
Power and fuel	Dependence on exposed delivery and utility routes remains	Increasing exposure of delivery and utility paths	Widespread road and site-edge exposure threatens continuity
Cooling	Indirect interruption remains possible	Access and power disruption can stop cooling even if equipment is dry	Direct and indirect interruption risks combine
Telecommunications	Unknown routing may cross exposed ground	Shared low crossings become more consequential	Loss of multiple low routes becomes credible

8 Conclusion

The flood-risk trajectory is clear even though the two evidence streams use different methods. For 2030, the public 1% annual-chance coastal extent covers 74.9% of 626 Lynnway and 37.5% of 680 Lynnway. It remains outside 0 Circle Avenue, with its nearest edge about 47 m from that parcel. Access risk is high because mapped sections of Hilton Avenue and Lynnway are already within the public flood extent. Commercial Street provides surrounding-network context.

For 2050, both 626 and 680 Lynnway are fully within the public extent and the Arkadiah compound stress test is deeper than 0.10 m across all model cells in each parcel. At 0 Circle, 6.4% lies within the public extent and the Arkadiah stress test exceeds 0.10 m across 43.6%. Access risk is very high because the public extent also reaches much of Circle Avenue and essentially all of the assessed Hilton Avenue and Lynnway centerlines.

For 2070, both Lynnway parcels remain fully exposed in both evidence streams. At 0 Circle, the public extent covers 16.7% and the Arkadiah stress test exceeds 0.10 m across 60.4%, with a P90 depth of 1.58 m. Access risk is very high, and external power and other dependencies form a major part of the risk. The central finding is operational: flood resilience depends on the connected building, access, power, cooling, communications, and drainage system.

About Arkadiah Technology

Arkadiah Technology develops AI-powered environmental intelligence solutions that combine satellite imagery, aerial and terrestrial LiDAR (laser-based 3D scanning), field data and other geospatial datasets to measure and monitor natural assets and the environmental risks that affect them. Its technology turns high-resolution 3D and Earth observation data into measurable indicators, including forest structure, biomass, carbon stocks and canopy change to terrain, drainage, flood exposure and infrastructure. Through its NatureOS Insights platform, Arkadiah supports forest and urban nature monitoring, carbon accounting, flood resilience, agriculture and infrastructure mapping, with projects across Asia, Africa and Latin America.

Leadership Team

Arkadiah is led by a highly experienced leadership team with a diverse background in earth observation and financial (fintech) / digital technology.

Reuben Lai
CEO & Co-Founder

Reuben Lai is a seasoned technology executive with a track record of leading successful businesses, including Grab Financial Group, where he started and grew into a unicorn.

Gerry Ong
Head of Geospatial & Co-Founder

Gerry Ong is a recognised leader in geospatial with over 30 years of experience. Gerry is also the Honorary President of the ASEAN Federation of Land Surveying & Geomatics (AFLAG).

Appendix A Arkadiah scenario results

Scenario	Rain (mm)	Coast level (m)	River flow (m^3/s)	Selected road location (m)	Road-analysis area max (m)
December 2022 historical coastal method check	29.97	2.581	2.407	0.0	0.0
July 2023 historical rainfall method check	44.58	1.801	5.635	0.0	0.0
131.6 mm design-rain screen	131.6	1.5	8.0	0.052	0.198
Current coastal screen	0.0	4.267	2.0	0.974	1.575
Current compound stress test	131.6	4.267	12.0	0.996	1.597
2050 compound stress test	131.6	5.029	12.0	1.828	2.432
2070 compound stress test	131.6	5.578	12.0	2.449	3.057

Coastal levels use NAVD88, the U.S. survey elevation reference used by the model. Historical runs are method checks. Current, 2050, and 2070 compound runs are sensitivity tests and do not have an assigned joint annual chance.

Model limitations

- The 20 m model grid does not resolve kerbs, road crowns, walls, door openings, small drains, or individual structures.
- The drainage network, pumps, tide gates, culverts, and final site grading are not represented.
- The uniform 2 mm/hour infiltration rate does not represent pavement, soil variability, or the capped former-landfill areas identified in public MassDEP records.
- The lidar-derived terrain supports screening but is not a current topographic survey, road-crown survey, or elevation certificate.
- No final datacenter footprint, pad elevation, external-equipment layout, or future utility routing is represented; the building and road shapes remain exposure-testing areas.
- Historical runs do not reproduce reported road-flood conditions at the selected road location and are not treated as calibration.
- Future compound tests change coastal level but do not use horizon-specific rainfall projections.
- The archived model distributes the 131.6 mm rainfall total over 6.75 hours. The report therefore describes the run as a design-rain screen.

Appendix B Horizon exposure measurements

Three-site parcel measurements

Scenario	Site	Max (m)	P90 (m)	Area over 0.10 m	Area over 0.30 m	20 m cells
Current coastal screen	0 Circle Avenue	0.702	0.063	7.9%	3.0%	101
Current coastal screen	626 Lynnway	2.153	1.818	100.0%	100.0%	45
Current coastal screen	680 Lynnway	1.791	1.403	100.0%	100.0%	23
Current compound stress test	0 Circle Avenue	0.723	0.098	9.9%	4.0%	101
Current compound stress test	626 Lynnway	2.175	1.841	100.0%	100.0%	45
Current compound stress test	680 Lynnway	1.814	1.425	100.0%	100.0%	23
2050 compound stress test	0 Circle Avenue	1.585	0.949	43.6%	35.6%	101
2050 compound stress test	626 Lynnway	3.034	2.698	100.0%	100.0%	45
2050 compound stress test	680 Lynnway	2.677	2.287	100.0%	100.0%	23
2070 compound stress test	0 Circle Avenue	2.222	1.584	60.4%	55.5%	101
2070 compound stress test	626 Lynnway	3.672	3.336	100.0%	100.0%	45
2070 compound stress test	680 Lynnway	3.318	2.926	100.0%	100.0%	23

These Arkadiah depth measurements use the fixed public MassGIS parcel screening boundaries. Dry active cells remain zero in every scenario, and P90 uses the discrete nearest-rank method.

Public horizon	Site	Parcel within 1% extent	Nearest extent when outside
2030	0 Circle Avenue	0.0%	46.8 m
2030	626 Lynnway	74.9%	Intersects
2030	680 Lynnway	37.5%	Intersects
2050	0 Circle Avenue	6.4%	Intersects
2050	626 Lynnway	100.0%	Intersects
2050	680 Lynnway	100.0%	Intersects
2070	0 Circle Avenue	16.7%	Intersects
2070	626 Lynnway	100.0%	Intersects
2070	680 Lynnway	100.0%	Intersects

The public MC-FRM values are geometric area intersections and do not carry depth values. Parcel boundaries support comparative screening and do not replace a boundary survey.

Illustrative building and road measurements

Scenario	Assessment element	Max (m)	90th percentile (m)	Area over 0.10 m
Current coastal screen	Building test area	0.000	0.000	0.0%
Current coastal screen	Assessment area	0.000	0.000	0.0%
Current coastal screen	Circle Avenue	1.281	1.252	100.0%
Current coastal screen	Hilton Avenue	1.791	1.791	100.0%
Current coastal screen	Lynnway	5.871	1.877	97.4%
Current coastal screen	Commercial Street context	2.037	2.002	66.7%
Current compound stress test	Building test area	0.068	0.056	0.0%
Current compound stress test	Assessment area	0.080	0.057	0.0%
Current compound stress test	Circle Avenue	1.303	1.275	100.0%
Current compound stress test	Hilton Avenue	1.814	1.814	100.0%
Current compound stress test	Lynnway	5.873	1.893	97.4%
Current compound stress test	Commercial Street context	2.061	2.025	96.3%
2050 compound stress test	Building test area	0.251	0.128	10.3%
2050 compound stress test	Assessment area	0.895	0.556	26.7%
2050 compound stress test	Circle Avenue	2.154	2.127	100.0%
2050 compound stress test	Hilton Avenue	2.677	2.677	100.0%

Scenario	Assessment element	Max (m)	90th percentile (m)	Area over 0.10 m
2050 compound stress test	Lynnway	6.666	2.725	99.0%
2050 compound stress test	Commercial Street context	2.942	2.878	96.3%
2070 compound stress test	Building test area	0.886	0.759	34.5%
2070 compound stress test	Assessment area	1.533	1.193	45.6%
2070 compound stress test	Circle Avenue	2.788	2.761	100.0%
2070 compound stress test	Hilton Avenue	3.318	3.318	100.0%
2070 compound stress test	Lynnway	7.250	3.350	100.0%
2070 compound stress test	Commercial Street context	3.649	3.524	100.0%

All values are Arkadiah measurements over approximate exposure-testing shapes and existing ground. The current scenarios use present-day labels. The official public MC-FRM source provides the 2030 evidence. The calculations use fixed geometry masks for every scenario, count dry active cells as zero, and use the discrete nearest-rank P90. Percentages and percentiles therefore remain comparable between runs.

Appendix C External public sources

Key	External public source	Reference
P1	Massachusetts Sea Level Rise and Coastal Flooding Viewer	https://www.mass.gov/info-details/massachusetts-sea-level-rise-and-coastal-flooding-viewer
P2	Massachusetts Coast Flood Risk Model data services	Official 2030, 2050, and 2070 1% annual-chance coastal flood extents
P3	Woods Hole Group MC-FRM	https://www.woodsholegroup.com/innovation/massachusetts-coast-flood-risk-model/
P4	Woods Hole Group 2030 shoreline data	https://woodsholegroup.com/mc-frm-data/LEVEL%201/2030/Shorelines/
P5	FEMA FIRM panel 25009C0529G, effective 16 July 2014	https://msc.fema.gov/portal/search
P6	MassGIS terrain data	https://www.mass.gov/info-details/massgis-data-lidar-terrain-data
P7	SFINCS model documentation	https://sfincs.readthedocs.io/en/latest/
P8	OpenStreetMap road data	© OpenStreetMap contributors; https://www.openstreetmap.org/copyright
P9	NOAA Atlas 14 precipitation-frequency information	https://hdsc.nws.noaa.gov/pfds/
P10	MassDEP inactive/closed landfill records	https://www.mass.gov/doc/list-of-inactiveclosed-landfills-dumping-grounds-in-massachusetts-august-2026/download
P11	MassGIS Property Tax Parcels	https://www.mass.gov/info-details/massgis-data-property-tax-parcels

Only the relevant public datasets were retained: the 2030 normal high-tide shoreline archive and the official statewide 1% annual-chance coastal flood extent files for 2030, 2050, and 2070. The three statewide files total 97.2 MB (92.7 MiB). The local OpenStreetMap road extract is about 1.1 MB, and the three-feature MassGIS parcel extract is about 3.4 KB.

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