

Geog 493: Digital Terrain Analysis
By Jordan Bertagnolli
12/3/2016

New Municipal Reservoir Proposal Using ArcGIS

Portland is expected to add another 120,000 residents by 2020, making it the fastest growing city on the West Coast. A growing population requires a larger water supply fed by massive municipal reservoirs. The city of Portland is interested in finding a site for a new reservoir that meets specific requirements. In this study I have categorized the requirements for a new reservoir and utilized digital terrain analysis via the ArcGIS software to determine the ideal location. I have established that a new reservoir must be at least 300 ft. in elevation to ensure proper gravity fed drainage for serving the Portland Metropolitan area. A reservoir must also be at least 200,000 sq. ft. large and on a slope of less than 10 degrees. Additionally, I have only selected sites that are public land with no existing buildings and that have equal or lesser environmental hazard risks than current existing reservoirs. My findings were that Loowit View Park is the only site in Multnomah County that meets all of the requirements for building a new reservoir. Loowit View Park, currently vacant land, sits at 347 ft. elevation, 235,000 sq. ft. of open space with no existing structures, no slope, and less environmental hazards in the surrounding area than comparable reservoirs such as Mt. Tabor. City owned Loowit View Park would require no costs to purchase. Specific to the needs of the Portland area, Loowit View Park provides the idea location for a municipal reservoir that will serve a growing city.

New Municipal Reservoir Proposal Using ArcGIS

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Digital Databases

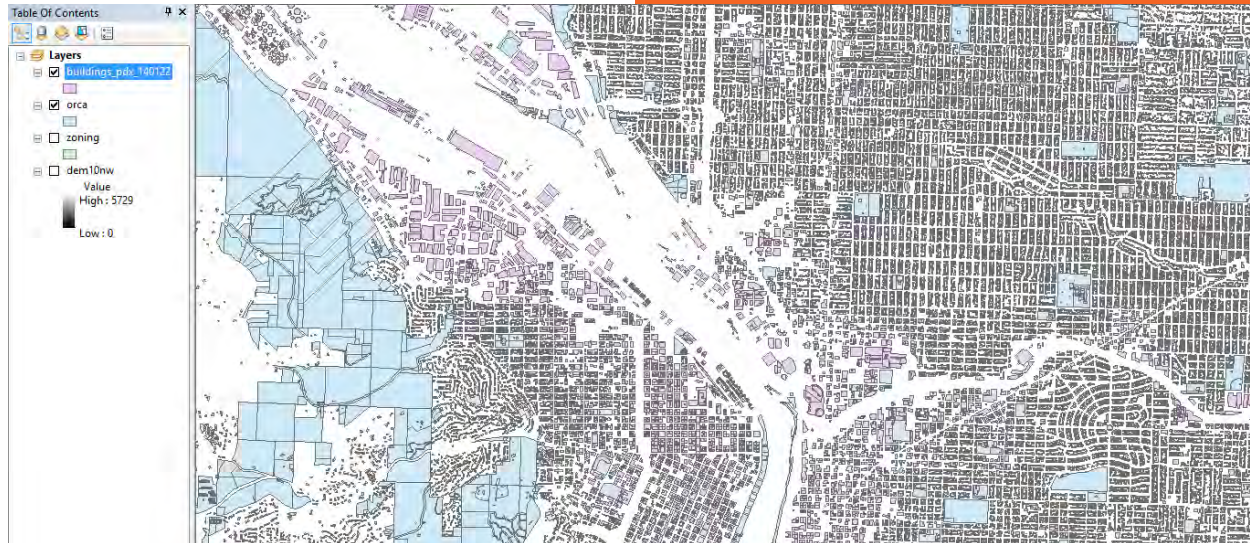
Portland RLIS (Parks layer)

Portland RLIS (Slope layer)

Oregon Geology Hazard Data
(earthquakes, flooding, landslides)

PSU Geography Dept. Samba (Buildings)

PSU Geography Dept. Samba (DEM)



1)Excluding small parks

Tool: Select by attribute

Removed parks <200,000 sq ft (4.6 acres)

Removed parks in Washington and Clackamas counties.

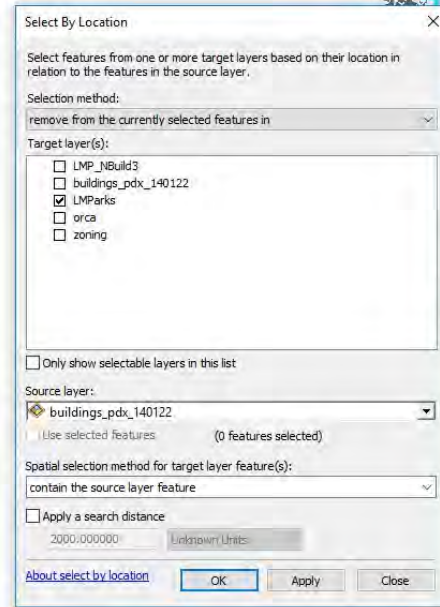


Table							
LMParks							
	FID	Shape *	SITENAME	UNITTTYPE	OWNER	OWNLEV1	OWNLE ^
▶	342	Polygon	Columbia River Gorge National Scenic Area	Natural Area	United States Forest Service	Federal	US Forest Service
	633	Polygon	Columbia River Gorge National Scenic Area	Natural Area	United States Forest Service	Federal	US Forest Service
	708	Polygon	Burlington Creek Forest	Natural Area	Unknown	Unknown	Unknown
	576	Polygon	Wapato Access	Natural Area	State of Oregon Parks & Recreation Department	State	State Parks and Recr
	882	Polygon	Columbia River Gorge National Scenic Area	Natural Area	United States Forest Service	Federal	US Forest Service
	800	Polygon	East Bliss Butte	Natural Area	Metro Parks & Environmental Services	Local	Regional
	464	Polygon	Columbia River Gorge National Scenic Area	Natural Area	United States Forest Service	Federal	US Forest Service
	751	Polygon	Columbia River Gorge National Scenic Area	Natural Area	United States Forest Service	Federal	US Forest Service
	606	Polygon	Columbia River Gorge National Scenic Area	Natural Area	United States Forest Service	Federal	US Forest Service
	386	Polygon	Bonneville State Scenic Corridor	Natural Area	State of Oregon Highway Commission	State	Other State
	707	Polygon	Forest Park	Park	Unknown	Unknown	Unknown
	617	Polygon	Kelley Point Park	Park	City of Portland Bureau of Parks & Recreation	Local	City
	461	Polygon	Forest Park	Park	City of Portland Bureau of Fire & Rescue	Local	City
	683	Polygon	Powell Butte Nature Park	Park	Metro Parks & Environmental Services	Local	Regional
	159	Polygon	Towle Butte	Natural Area	Metro Parks & Environmental Services	Local	Regional
	383	Polygon	Columbia River Gorge National Scenic Area	Natural Area	United States Forest Service	Federal	US Forest Service
	629	Polygon	Columbia River Gorge National Scenic Area	Natural Area	United States Forest Service	Federal	US Forest Service

1 | (0 out of 1176 Selected)

LMParks

Attribute table after selecting for only natural areas and parks.

Table									
LMParks									
	MANAGER	CITYMUNI	COUNTY	GISACREAGE	STATUS	BONDACQ	CONSERVATI	RECREATION	DISSOLVEID
▶	United States Forest Service	Unincorporated	Multnomah	5.001558	Unknown	0	High	Some	680
	United States Forest Service	Unincorporated	Multnomah	5.002702	Unknown	0	High	Some	680
	Metro	Unincorporated	Multnomah	5.003228	Unknown	0	Medium	Unknown	424
	State of Oregon Parks & Recreation Department	Unincorporated	Multnomah	5.00416	Open	0	High	Yes	2569
	United States Forest Service	Unincorporated	Multnomah	5.007214	Unknown	0	High	Some	680
	Metro Parks & Environmental Services	Unincorporated	Multnomah	5.010239	Unknown	1	High	Unknown	847
	United States Forest Service	Unincorporated	Multnomah	5.011762	Unknown	0	High	Some	680
	United States Forest Service	Unincorporated	Multnomah	5.014311	Unknown	0	High	Some	680
	United States Forest Service	Unincorporated	Multnomah	5.01547	Unknown	0	High	Some	680
	State of Oregon	Unincorporated	Multnomah	5.02026	Closed	0	Medium	None	334
	City of Portland Bureau of Parks & Recreation	Portland	Multnomah	5.020812	Open	0	High	Yes	996
	City of Portland Bureau of Parks & Recreation	Portland	Multnomah	5.024629	Open	0	High	Yes	1391
	City of Portland Bureau of Fire & Rescue	Unincorporated	Multnomah	5.024974	Open	0	Medium	Yes	996
	City of Portland	Portland	Multnomah	5.046291	Open	1	High	Yes	1971
	Metro Parks & Environmental Services	Gresham	Multnomah	5.055792	Unknown	1	High	Unknown	2468
	United States Forest Service	Unincorporated	Multnomah	5.072604	Open_Restricted	0	High	Yes	680
	United States Forest Service	Unincorporated	Multnomah	5.072631	Unknown	0	High	Some	680

1 (0 out of 1176 Selected)

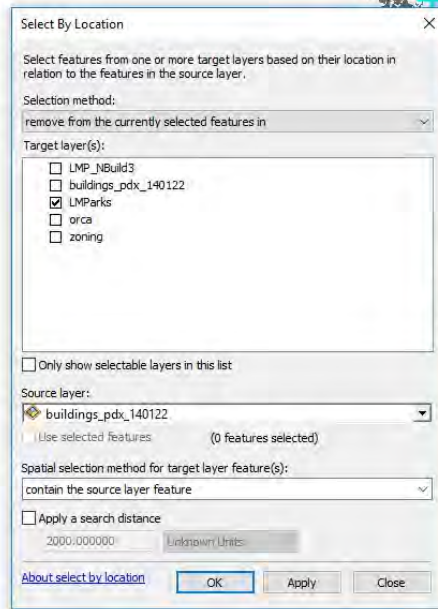
LMParks

Attribute table after selecting for >200,000 sq ft and Multnomah counties

2) Excluding parks with Buildings

Tool: Select by location

Spatial selection method: partially contained by the source layer, fully containing the source layer.

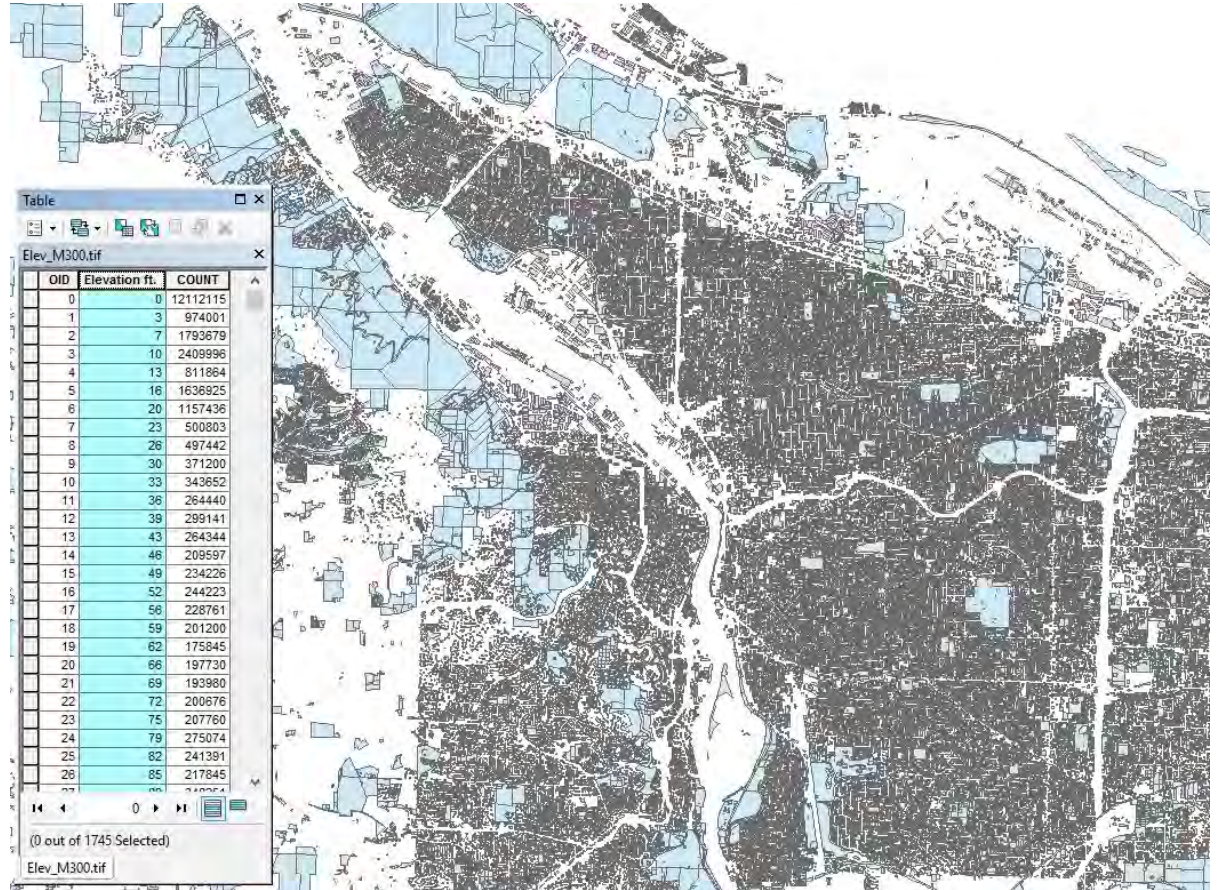


3) Exclude low elevation parks

Tool: Select by attribute

Performed join on the dem points with the parks layer.

Using the new joined layer, I Selected for parks >300ft elevation and exported the selection as a new layer.

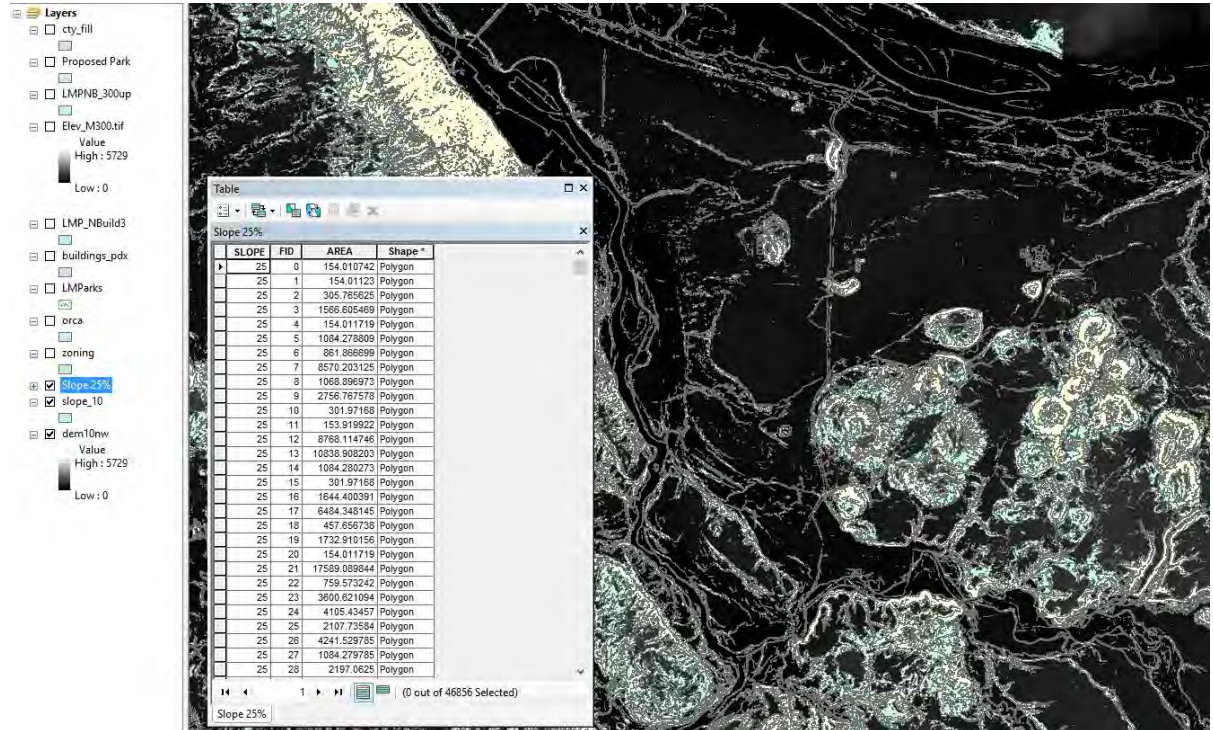


4) Evaluate for Slope

Imported slope layer from the RLIS Environ database.

Tool: Intersect

Excluded points that exceeded 10 degrees of slope. Selected for park polygons that intersected slope points below 10 degrees.



	FID	Shape *	SITENAME	UNITTYPE	OWNER
▶	0	Polygon	East Holladay Park	Park	City of Portland
	1	Polygon	Ventura Park	Park	City of Portland Bureau of Parks & Recreation
	2	Polygon	Big Four Corners Natural Area	Natural Area	City of Portland Bureau of Parks & Recreation
	3	Polygon	Loowit View Park	Park	City of Portland Bureau of Parks & Recreation
	4	Polygon	Argay Park	Park	City of Portland

After considering slope, only five parks remained.

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All five parks are east of I-205 in northeast Portland.

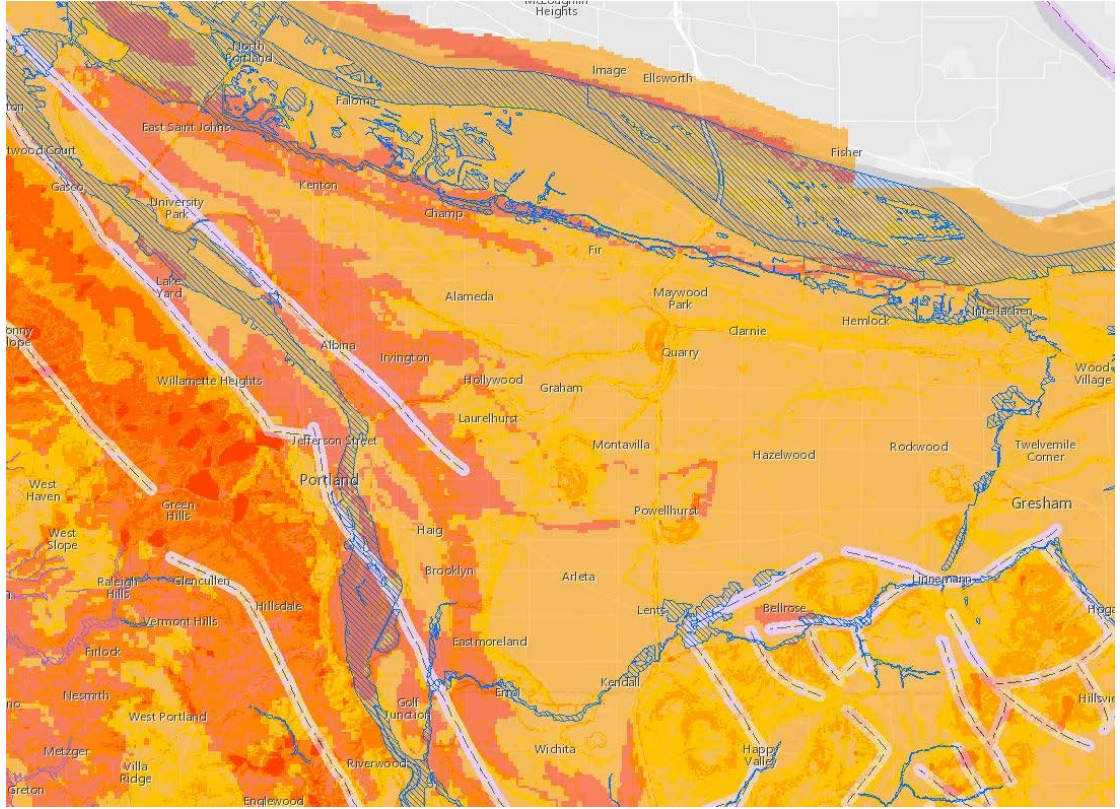


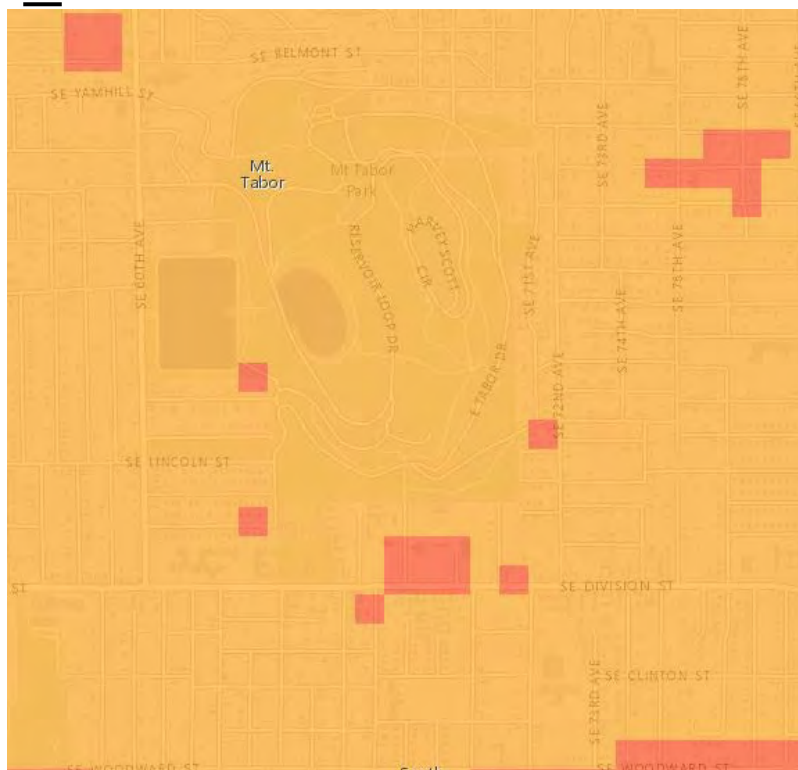
5) Analyzed for Hazards

Database: Oregon Geology Hazard Data.

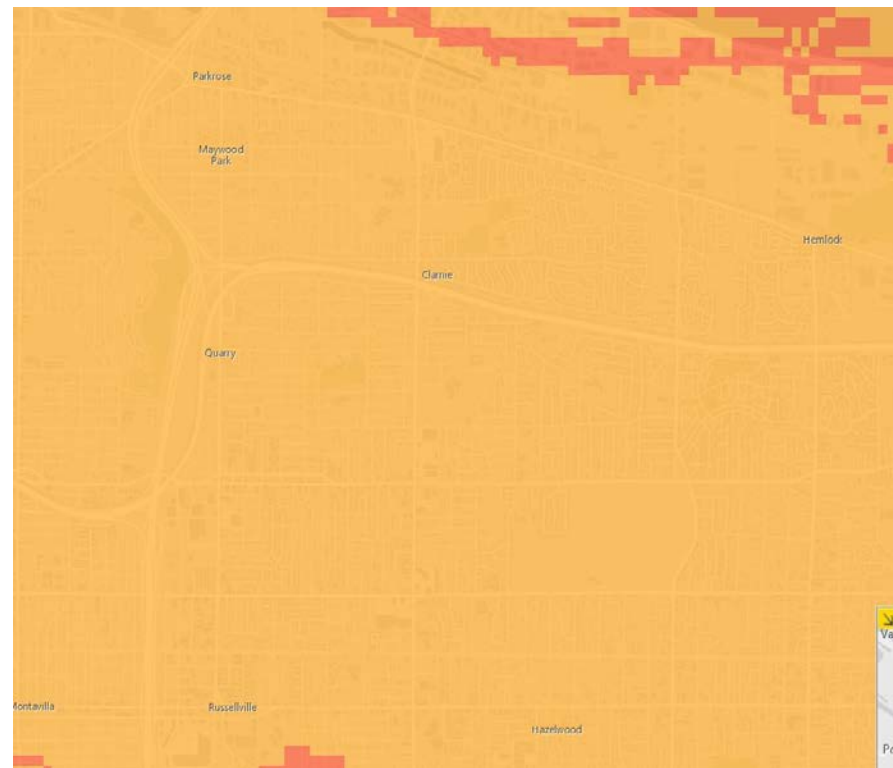
Hazards: earthquakes, landslides, flooding.

Excluded park sites with hazard levels exceeding those of existing reservoirs.





Inner southeast Mt. Tabor reservoir.



Northeast area of all five proposed reservoir sites.

6) Visual Inspection

Remaining sites: 5

Each has drawbacks.

Surrounding areas were considered.



East Holladay Park



Ventura Park



Big Four Corners Natural Area.



Argay City park

Proposed Location

Loowit View Park



22,000 Feet

Source: Portland State geography Dept. 2016
By Jordan Bertagnoli



Legend

- Proposed Park
- buildings_pdx



FID	Shape	SITENAME	UNITTYPE	OWNER
0	Polygon	East Holiday Park	Park	City of Portland
1	Polygon	Venue Park	Park	City of Portland Bureau of Parks & Recreation
2	Polygon	Big Four Corners Natural Area	Natural Area	City of Portland Bureau of Parks & Recreation
3	Polygon	Loowit View Park	Park	City of Portland Bureau of Parks & Recreation
4	Polygon	Argay Park	Park	City of Portland

Identify from:	Equidistant Spheroid
Pls15SLP	Argay Park
Location:	795,293,920 1,292,567,528 Unknown Units
Field	Value
UNITTYPE	Park
OWNER	City of Portland
OWNER1	Local
OWNER2	City
OWNER3	City of Portland
MANAGER	City of Portland
CITYMUN	Portland
COUNTY	Multnomah
GISACREAGE	9,920,263
STATUS	Open
BONDACQ	0
CONSERVAT	Low
RECREATION	Yes
DEVELOPED	113
Rowid	293
VALUE	961
COUNT	291853



Loowit City Park is the ideal location for the city of Portland's new municipal reservoir.

Sources

- 1) Chen, X. (2011, December 28). Stability analysis of bank slope under conditions of reservoir impounding and rapid drawdown. Retrieved December 05, 2016, from <http://www.sciencedirect.com/science/article/pii/S1674775515301414>
- 2) Hooshyaripor, F. (2015, April 08). Engineering Applications of Computational Fluid Mechanics. Retrieved from <http://www.tandfonline.com/doi/full/10.1080/19942060.2015.1039630>
- 3) Renfro, G. (2011, November 04). Ponds and Reservoirs. Retrieved from <https://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17549.wba>