



Cherry Creek Basin Water Quality Authority
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Memorandum

To: Rick Goncalves, TAC Chairman
Cc: Chuck Reid, Manager
From: William P. Ruzzo, P.E.
Date: March 27, 2014
Re: Cherry Creek Reservoir Area-Capacity Data w/Additional Topo

The Cherry Creek Basin Water Quality Authority (Authority) prepared a memorandum¹ presenting area-capacity data for Cherry Creek Reservoir based on a bathymetric survey prepared for the Authority by Absolute Natural Resources (ANR) in 2013. Surface area and storage capacity was provided from elevation 5512 through elevation 5550 (Local Project Datum), which is the normal pool or multipurpose pool elevation. These data were prepared to assist Hydros Consulting, Inc. (Hydros) in the development of a reservoir water quality model for Cherry Creek reservoir.

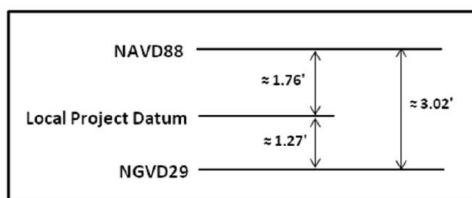
The purpose of this memorandum is to extend the area-capacity data above 5550 to elevation 5558.2 using topographic information prepared using LiDAR techniques and provided by Southeast Metro Stormwater Authority (SEMSWA). The SEMSWA LiDAR data was flown in 2008 and based on NAVD88 datum. SEMSWA provided the data in GIS and AutoCAD formats with 2-foot contour intervals. The highest recorded elevation in the reservoir from 1990 to 2009 was 5553.3²; therefor Hydros requires the area and shape of the contours above 5550 for the reservoir model.

Since the 2008 LiDAR topography was prepared based on NAVD88 datum, the LiDAR contour elevations were converted to Local Project Datum using the following diagram³ prepared by the Army Corps of Engineers (USACE):

¹ Ruzzo, William P. and Wolf, Craig Amended February 27, 2014. *Cherry Creek Reservoir Area-Capacity Data, Amended.*

² USACE July 2011. *Tri-Lakes Sedimentation Studies Area-Capacity Report.* Page F-7

³ USACE July 2011. Page 2-7.



The surface area of the 2008 LiDAR contours were then determined using CAD techniques for elevations 5552.2, 5554.2, 5556.2, and 5558.2. The volumes between these contours were then determined using the same equation presented in memorandum that analyzed the bathymetric survey⁴.

RESULTS

Presented in Table 1 are reservoir areas and volumes for elevations 5512 to 5550 in 1-foot increments and from 5552.2 to 5558.2 in 2-foot increments, with all elevations based on Local Project Datum.

The SEMSWA 2008 LiDAR GIS data file was also combined with the ANR 2013 bathymetric GIS data file by Leonard Rice Engineers and transmitted by email to Hydros on March 27, 2014 for use in the reservoir model.

COMPARISON TO USACE RESULTS

Figure 1 shows storage volume as a function of elevation for the ANR\SEMSWA topography compared to the 2009 USACE survey. The volume determined from ANR\SEMSWA topography is consistently higher than the volume reported in the USACE 2011 report, with a difference of ~1,500-acre feet at ~ elevation 5558 (~7% higher).

Figure 2 shows surface area as a function of elevation for the ANR\SEMSWA topography compared to the 2009 USACE survey. The surface area determined from ANR\SEMSWA topography is consistently larger than the volume reported in the USACE 2011 report, with a difference of ~50-acres at ~ elevation 5558 (~5% larger).

Possible reasons for differences with the USACE published results are discussed in the bathymetric survey memorandum. The results presented herein are believed to be suitable for use in the reservoir model as well as for future work by the Authority in Cherry Creek State Park.

- Table 1 – Reservoir Volume and Surface Area
- Figure 1 – Storage Volume Comparison ANR 2013 and SEMSWA 2008 LiDAR Surveys vrs USACE 2009 Survey
- Figure 2 – Surface Area Comparison ANR 2013 and SEMSWA 2008 LiDAR Surveys vrs USACE 2009 Survey

⁴ Ruzzo 2014.

CHERRY CREEK BASIN WATER QUALITY AUTHORITY
Table 1 - Reservoir Volume and Surface Area

Normal Pool El = 5550.0 based on Local Project Datum

Depth	Contour Elevation	Area (acres)	Volume Acre Feet	
			Vol.	Cumulative
-38	5512	0.0	n/a	0
-37	5513	0.0	0.0	0
-36	5514	0.0	0.0	0
-35	5515	0.0	0.0	0
-34	5516	0.0	0.0	0
-33	5517	0.0	0.0	0
-32	5518	0.0	0.0	0
-31	5519	0.0	0.0	0
-30	5520	0.1	0.1	0
-29	5521	0.1	0.1	0
-28	5522	0.2	0.1	0
-27	5523	0.5	0.4	1
-26	5524	1.9	1.1	2
-25	5525	25.8	11.6	13
-24	5526	165.1	85.4	99
-23	5527	239.7	201.3	300
-22	5528	279.8	259.5	560
-21	5529	315.0	297.2	857
-20	5530	344.7	329.7	1187
-19	5531	387.3	365.8	1552
-18	5532	416.6	401.9	1954
-17	5533	440.2	428.3	2383
-16	5534	467.6	453.9	2836
-15	5535	490.6	479.1	3315
-14	5536	514.5	502.5	3818
-13	5537	546.2	530.3	4348
-12	5538	563.9	555.0	4903
-11	5539	590.2	577.0	5480
-10	5540	613.8	602.0	6082
-9	5541	635.1	624.4	6707
-8	5542	656.8	645.9	7353
-7	5543	683.1	669.9	8022
-6	5544	711.6	697.3	8720
-5	5545	742.0	726.7	9446
-4	5546	772.2	757.1	10204
-3	5547	804.2	788.1	10992
-2	5548	833.5	818.8	11810
-1	5549	857.0	845.2	12656
0	5550	875.5	866.2	13522
2.2	5552.2	925.9	2017.3	15539
4.2	5554.2	986.7	1912.2	17451
6.2	5556.2	1048.6	2035.0	19486
8.2	5558.2	1114.7	2162.9	21649

NOTE: 1 - Values from 5512 through 5550 based on survey by Absolute Natural Resources performed November 18-27, 2013
2 - Values above 5550 based on 2008 LiDAR topo data provided by SEMSWA and converted from NAVD88 to Local Project Datum

Figure 1 - Storage Volume Comparison
ANR 2013 and SEMSWA 2008 LiDAR Surveys vrs USACE 2009 Survey

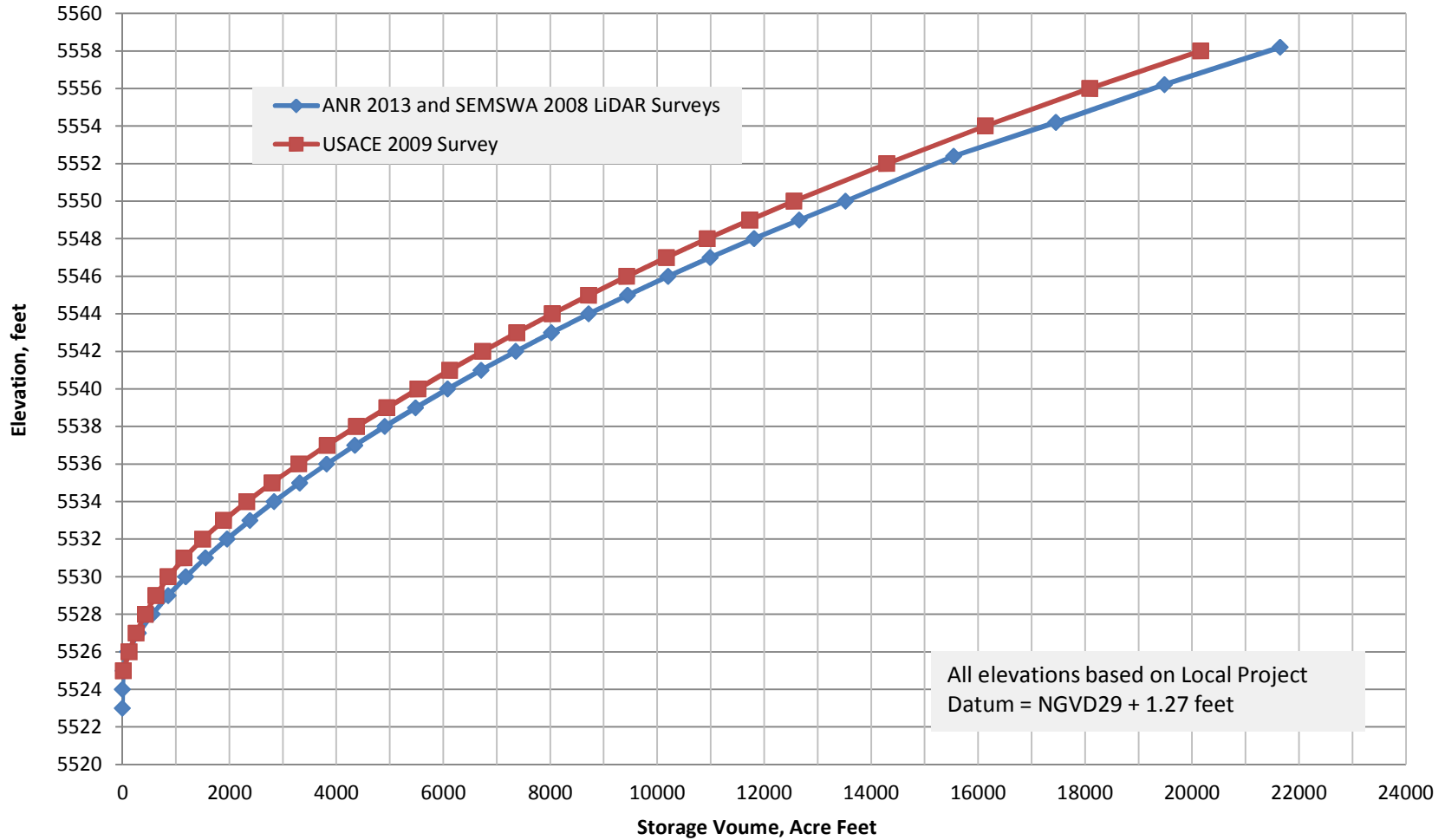


Figure 2 - Surface Area Comparison
ANR 2013 and SEMSWA 2008 LiDAR Surveys vrs USACE 2009 Survey

