

## Comments and Concerns about the Construction Plans for the Serene Conservancy.

by Dr. Ed Holroyd

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Relevant background: I have been the volunteer caretaker of the Serene Conservancy (Strippgen) property since early 2006 and have walked over it to within a few yards of all locations during noxious weed management. I worked as a research scientist for the U.S. Bureau of Reclamation for 31 years, initially in weather research. From 1988 to retirement in 2005 my main activities were in the fields of remote sensing, geographic information systems, and digital image processing. From 1999 to retirement in 2016 I taught these things at the graduate level at the University of Denver. Since about 1990 my analysis software has been what is now called TNTmips from MicroImages, Inc., of Lincoln, Nebraska. It is not one of the major brands but has the same analysis functions and is easier to use. I am presently using its 2020 version on my home computers.

Important items described below:

1. Major location errors, about 18 feet N-S in property boundary positions.
2. Existing safety fence locations.
3. Irrigation pipe pathway north of the upper pond.
4. Location map of well heads not described in the Construction Plans.
5. Location map of old fence posts not described in the Construction Plans.
6. Reminder of pits and likely drainage pipes in the Playground area.
7. Reminder that the existing gravel trail functions as a levee at its northern and eastern sections. The southern loop has a huge area of gravel fill previously communicated but not acknowledged in the construction plans.
8. An idea of heresy?
9. Water use adjustments.

### **Georegistration**

In making maps of property surface features it is of utmost importance that locations are accurate. Modern GPS technology easily provides positions to centimeter accuracy for surveying, though simple handheld GPS devices provide positions only to accuracies of a few meters. More than a decade ago I used a theodolite, tape measure, and various targets to survey much of the property with expected 3D accuracy to centimeters, with nearly 3000 measurement points. I have recovered some of the location measurements for this report, being more accurate than with a handheld GPS unit.

### *Datum*

Mathematical models of the shape of the Earth, called datum, have significant differences. American topographic maps of previous decades use a datum known as NAD27 (North American Datum 1927) for converting latitude and longitude to ground position. With the arrival of satellite technology there has been a revision to two nearly identical systems, NAD83 and WGS84 (World Geodetic System 1984), the latter which is used for GPS.

In addition there is a necessary conversion from the spherical coordinate system of latitude/longitude by projection models into a planar coordinate system used for maps. One of the common systems is the Universal Transverse Mercator (UTM) which converts coordinates into north-south strips from pole to equator with widths of 6 degrees of longitude and a central meridian. For Colorado the UTM zone is 13N with central meridian 105 degrees west. UTM positions are usually expressed in meters as northing north of the equator and easting eastward from the west side of the zone. In my graduate classes at DU I showed an example converting a

geographic location somewhat northwest of Denver, N 40 deg, W 105 deg, to UTM meters using two different datums, NAD27 and WGS84. The numerical difference between the two resulting coordinates is 208.343 meters in northing and 45.692 meters in easting for a total difference (diagonal) of 213.295 meters (0.133 mile, 700 feet). That is huge, showing how important it may be to know which datum is being used.

For a standard georegistration reference I am using a USGS DOQQ (digital orthophoto quarter quad) for our area, which uses GRS84 and UTM zone 13N, with 0.328 meter (1 foot) pixels and 2006 imagery. It provides many visual references for transferring its (ground truth) geographic coordinates to other visual imagery.

For a more modern visual reference I made screen-captures of portions of Google Earth imagery of the park, with imagery taken 12 September 2019. I spliced the resulting tiles together using pixel matching, making a mosaic with possible splicing errors of only about 1 pixel. The result I georeferenced using the DOQQ and landmark matchings. The calculated resolution was 0.104 meters per pixel, though the actual aerial imagery is likely coarser. The georeferenced Google Earth image is therefore an excellent visual reference for the entire area of the Serene Conservancy.

## **1. Construction Maps**

I made paper prints of all pages of the Construction PDF that contained maps. I scanned each page at 800 dpi and adjusted the brightness and contrast to make the elevation contours much darker. Then I extracted each map from its page, discarding whatever was beyond the map borders. Page 3 is an overview. Pages 4 and 5 have a scale twice improved. I spliced pages 4 and 5 together using pixel matching, intending to use it to georeference all other maps on subsequent pages. I will call the georeferenced splice "p4+5".

It was easy creating a georeference of p4+5 using property boundaries visible as fence corners in the Google image. The Alford-Selman Lateral Ditch also matched visual landmarks in the property boundary version.

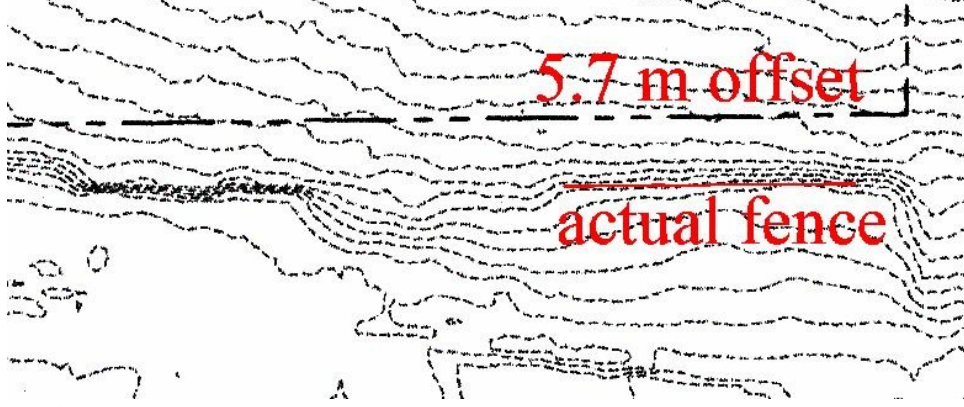
### *Major map position error!*

However, it was soon noticed that all terrain shown by the elevation contours was then offset an obvious distance to the south of where it should be using the property georegistration process. The east-west positions appeared acceptable. Therefore a separate georegistration was created by adjusting obvious elevation landmarks northward to their correct positions. The result lets the elevation contours match their locations with respect to the Google image. The offset errors measured 5.0 to 5.7 meters, with about 5.5 meters (18 feet) being a temporary working value.

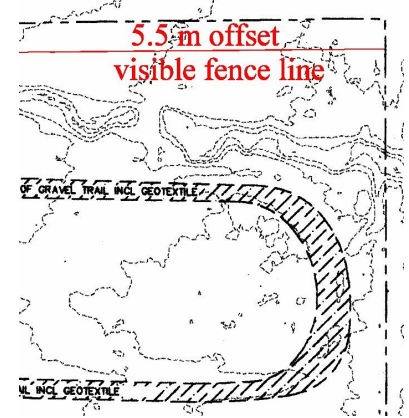
Most of the crusher-fine pathway, because of the cut and fill notations, appears to be tied to the elevation contours and is therefore interpreted that way. However, some portions may contain the 5.5 meter error, as indicated below.

The picnic and playground area encroaches into the entrance pond's east end, and a southward movement would avoid that overlap. The south end of the concrete picnic area is drawn about 5 meters north of the southernmost existing concrete, consistent with all the other offsets. The rail fence extending south and then westward from the picnic area eventually is drawn following the property boundary, but that boundary has the observed offset error and the fence position therefore needs correction. The irrigation pattern for the picnic and playground area is tightly associated with those features as drawn, making it suspect of having the same offset error. As drawn, the entrance path does not mesh properly with the actual parking lot edge, having the same offset error. That entrance path, as drawn, ignores the parking lot drainage channel and therefore needs a drainage pipe under it. Furthermore, as drawn, it diverts into the willows and over a major well head. Therefore the concrete entrance path to the picnic and playground needs to be redrawn westward as well as southward.

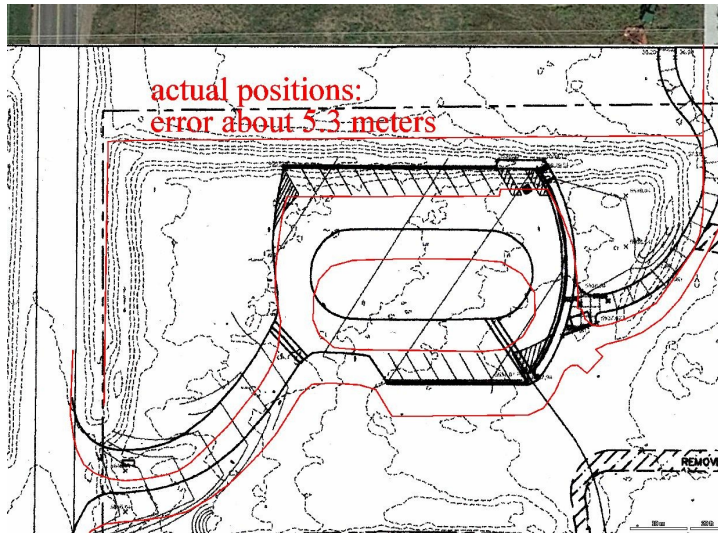
The following extracts show the comparison between the construction map property boundaries and the actual positions. The offsets are measured approximations and should be refined.



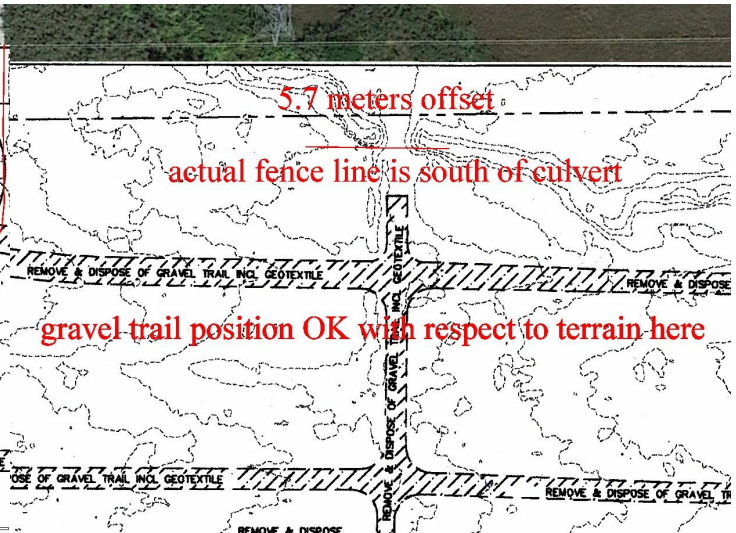
southeast corner



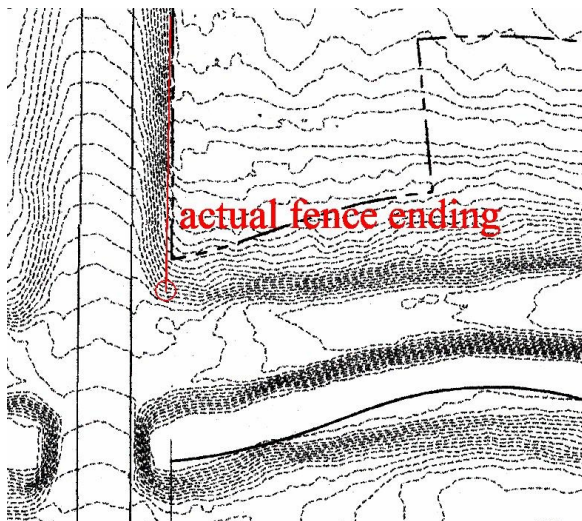
northeast corner



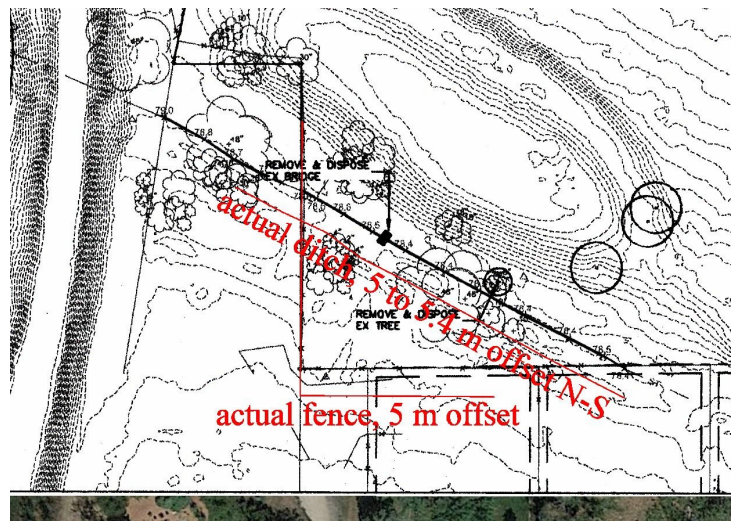
northwest corner



north center



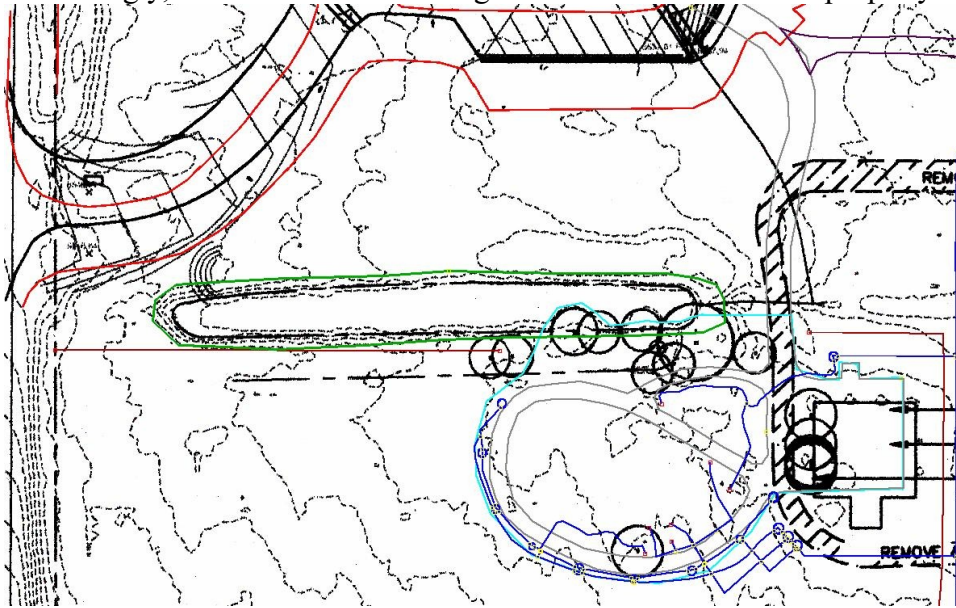
road and canal: WSW corner



southwest corner

## 2. Safety Fences

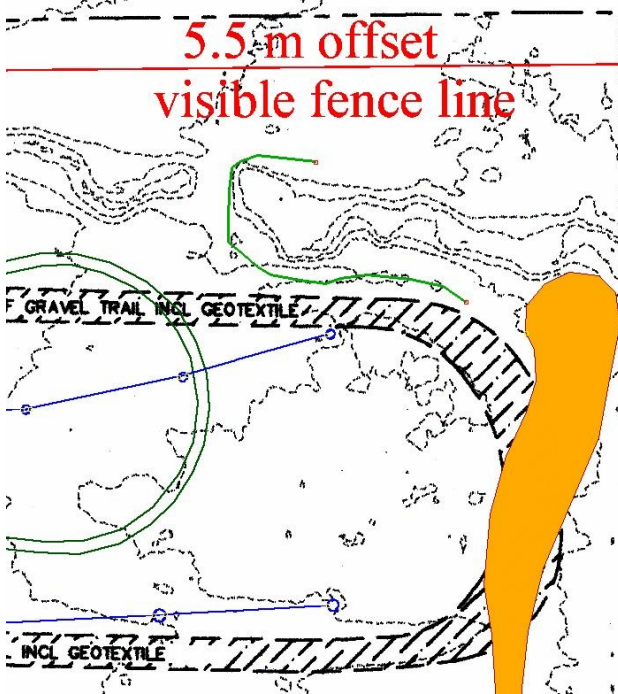
During my last dozen or so years with the U.S. Bureau of Reclamation, one of my extra duties was to serve as the safety officer for our work group. I had many training courses and am therefore sensitive to such issues. Accordingly, I have left intact fencing and erected others on the property. Some should not be removed.



West, entrance pond and safety fence in green

The west pond at the entrance has very steep banks which are of very slippery clay when wet. I erected this fence at the top edge of the cliff edges so that people, running kids, dogs, etc. cannot accidentally fall into the pond.

The playground is likely drawn 5.5 meters too far north and overlaps the pond edge. Correcting the playground map position eliminates the conflict with this safety fence. This fence should not be removed because of the expected nearby activities.

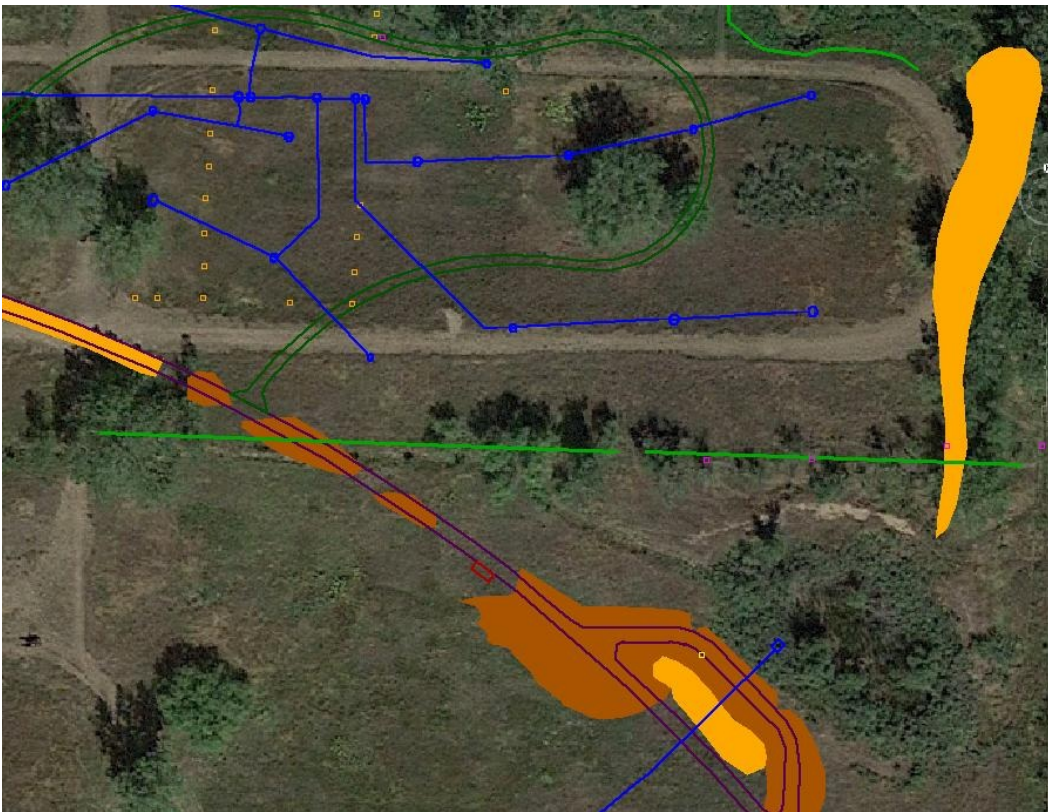


Northeast corner, Van Bibber Creek safety fence

Early this year when the general public began much use of the gravel trail for walking themselves and dogs, I noticed how close they got to the collapsing banks of the Van Bibber Creek. It was an obvious safety issue. So I erected the fence indicated as the medium green line. The dark green circular green is the proposed grassy pathway of the construction proposal. The yellow area is a cut for drainage. The blue features are parts of the irrigation system. The 5.5 meter position error could be present in the Construction features.

To the west of the small culvert the creek banks are not collapsing and are adequately away from present and future pathways. So a fence does not seem to be needed there. My new fence does not interfere with future plans. It provides safety for people who wander off the designated pathway. Its open ends allow people into the safe parts of the creek edges, such as for dog watering and plant inspections, if they wish to do so. So I recommend leaving this safety fence in position as the banks continue to collapse and erode.

The west end of the middle fence is on the north rim of the central ditch. The east end used to continue to the property line. It is shown as a pair of straight green lines. The gap in the middle is for the passage of deer and coyotes. It was an existing fence. It does not have a major safety purpose and can be removed. The ditch can be an inconvenience to travel across the field, especially when wet in the Spring, but is obvious to a walker.



This fence needs to be cut anyway by the crusher-fine pathway (dark red parallel lines). The yellow areas are cuts and the orange areas are fills. The blue features are proposed irrigation components. The curved green parallel lines are the grassy path. The tiny orange squares are existing wooden posts, some of which may be removed. Though the crusher fine pathway appears to be properly located, some of the other construction features may have the 5.5 meter position error.

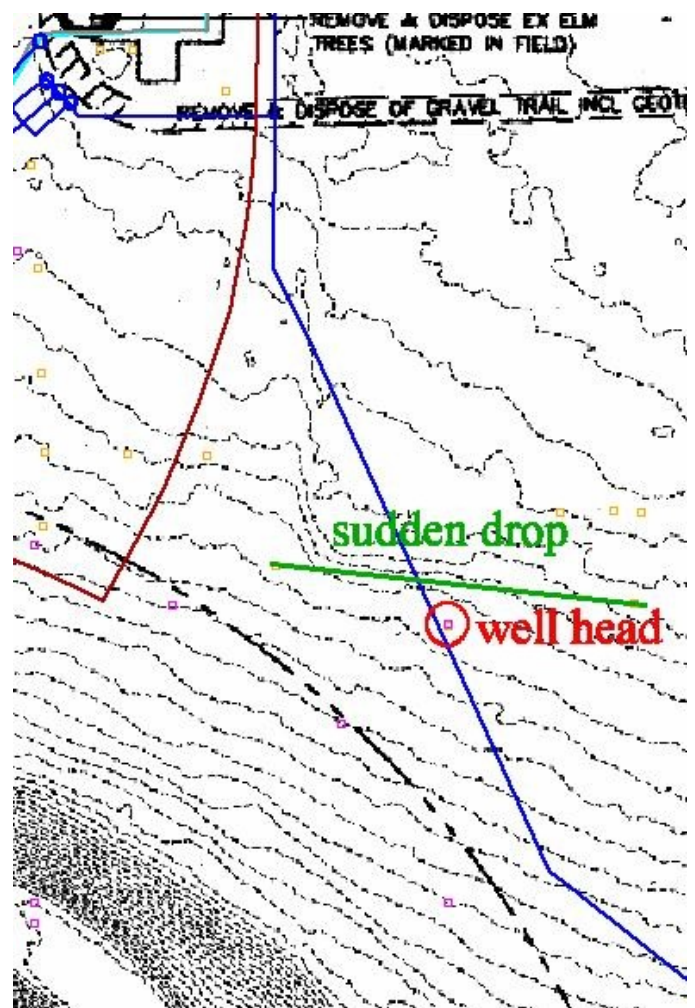
Middle fence, shown as straight green lines.

I erected a fence line on the southwestern slopes as the southern boundary of a large area being seeded with prairie grass. A large mound had been removed and used to partly fill a depression where there had been a greenhouse. Eventually I dismantled much of that fence line. However, I left intact the indicated segment. Its west end provides a mild safety feature so that casual walkers in the field do not get surprised by the sudden drop in elevation. In the illustration the red line is the proposed rail fence line, adjusted about five meters southward. The dashed black line is the property boundary which is about 5.5 meters too far north on this mapping.

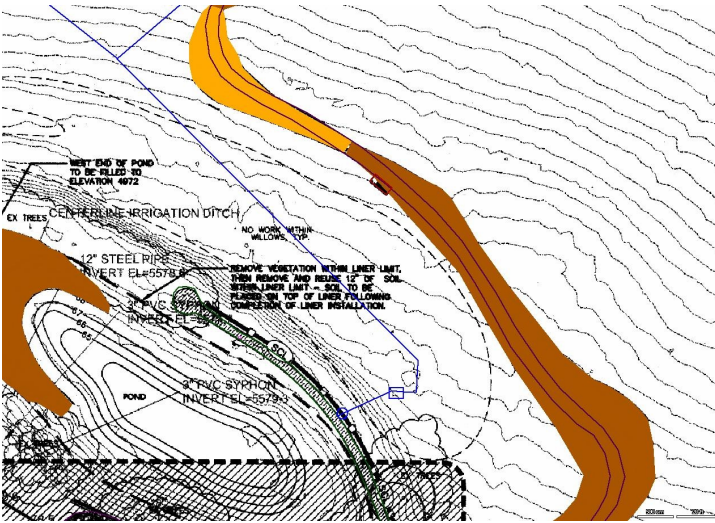
### 3. Irrigation supply pipe

The blue line is the proposed irrigation supply pipe. To avoid the sudden drop in elevation, I suggest that the irrigation pipe be diverted around the west end of this fence on its way to the picnic area. As drawn it also crosses a hidden well head pipe (circled red square just below the green line) that I have marked in the field with a T-post.

The upper portion of that irrigation supply pipe has an additional problem shown in the next images. On page 11 the construction instructions say that there should be no work within the willows. However, on page 38 the



Southwest fence as green line



The small central message says "NO WORK WITHIN WILLOWS." The thin dashed line approximates the extent of the willows.

present it is very challenging to walk through those willows because of interlocking curved dead branches. The yellow area is a cut; the brown areas are fill. The parallel dark red lines are the crusher-fine pathway.



The blue irrigation pipe line runs in the middle of the willows. irrigation pipe location passes right through the middle of them. That will create a major construction scar.

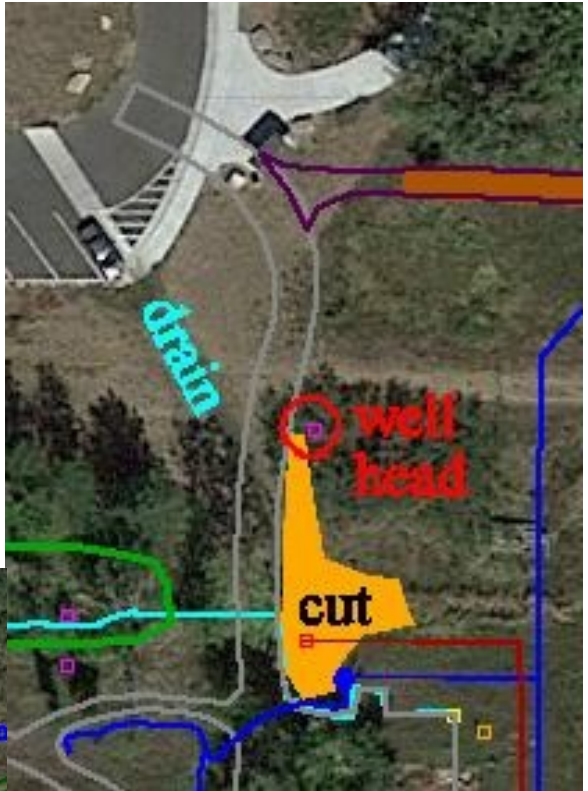
#### 4. Hidden Well Heads

One hidden well head has already been mentioned that will interfere with construction plans. There are more.

As previously mentioned, the picnic and playground drawings appear to suffer from the 5.5 meter offset, making them farther north on the terrain than they should be. In the illustration, the gray parallel lines show the proposed concrete pathway from the parking lot to the picnic and playground areas, without correction for the position error. The diagrams do not mention a drainage pipe under the concrete path to accommodate the drainage from the parking lot. They do not mention the pipe from the entrance pond to the middle drainage ditch. They do not indicate the major well head facility hidden in the willows. Though the rest of the crusher-fine trail (maroon lines with orange fill) seems to be properly positioned with respect to the terrain, this ending near the parking lot suffers from the 5.5 meter offset of the rest of the construction features in this area.



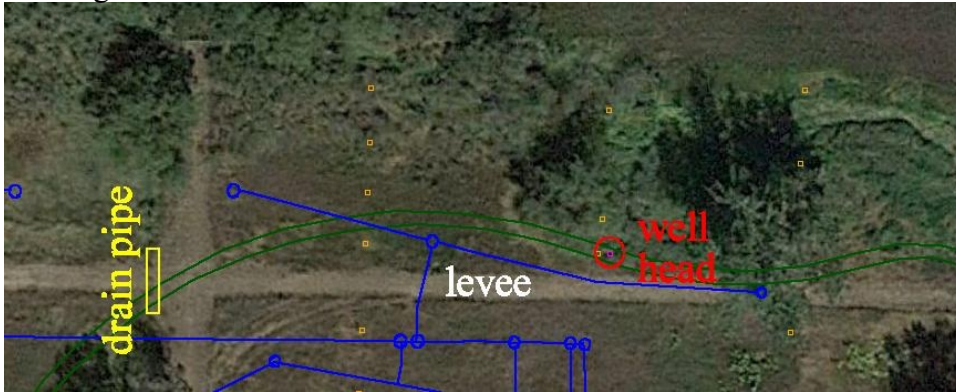
North part of gravel trail, west end, with wells (red) and posts (yellow)



Access path to picnic and playground areas

Under the large cottonwood trees north of the northern gravel trail (levee) are two large circular wells now covered with a

wooden rectangular box. As drawn, the irrigation system cuts through this well location. However, if the irrigation system suffers the typical 5.5 meter offset to the north, a corrected position will avoid interfering with that large well.



Water-related features in the central north, adjacent to Van Bibber Creek

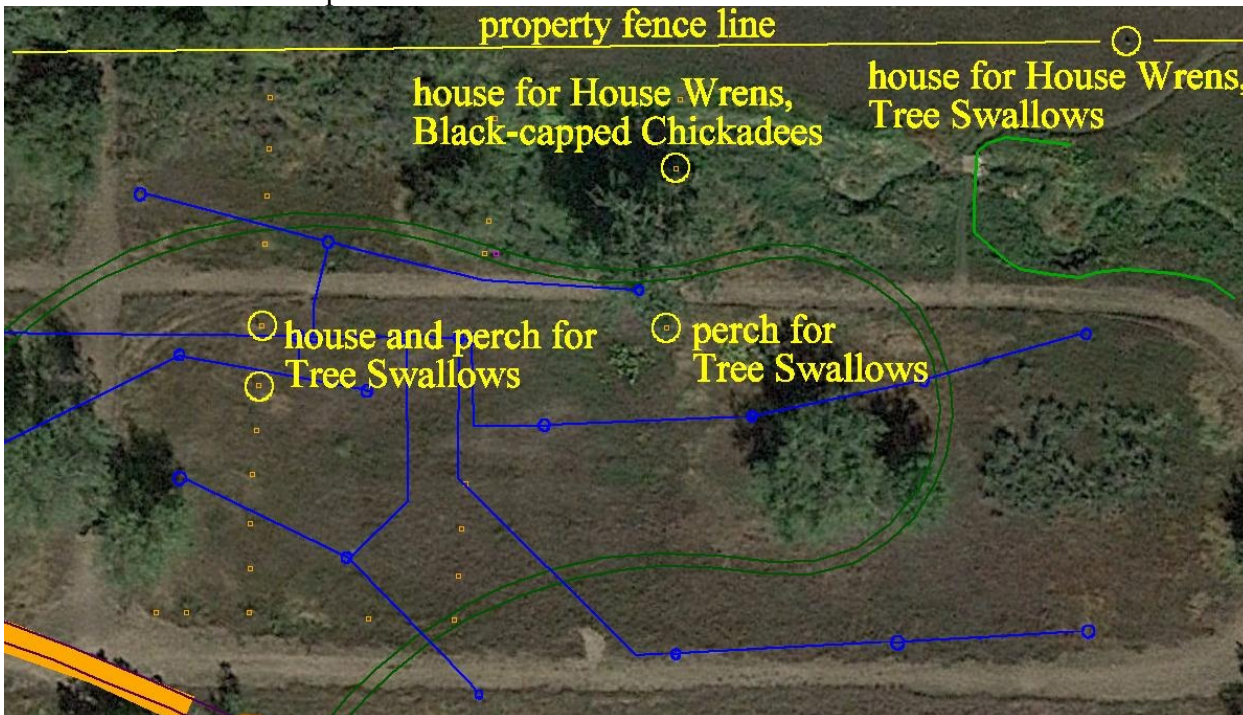
Farther east at the northern gravel trail intersection is a large pipe that lets excess water drain northward to Van Bibber Creek (at the top edge of this view). During the September 2013 flood the gravel trail functioned as an important levee, keeping most of the flood water to its north side. However, water flowed southward (backward) through the drain pipe, permitting a flooding within the eastern loop of

the gravel trail. If not for the southern part of this loop also functioning as a levee, the flood water would have reached the drainage ditch that leads to the eastern pond. (See later drawing) The construction plans show no knowledge of this important drain pipe, nor the importance of the gravel trail as a levee.

There is another hidden well head, shown in the image as the circled red small square. As drawn, the proposed grassy trail passes over it and parts of the proposed irrigation system are nearby. At that location the grassy trail passes too close to Van Bibber Creek and under low-hanging tree branches. If the construction drawing of these features suffers from the 5.5 meter position error, a corrected position about 18 feet to the south would avoid the conflicts.

## 5. Old Wooden Fence Posts

In the previous images are small orange squares. They are locations of wooden fence posts, likely with concrete bases. Most no longer serve a purpose and could be removed. However, some support active bird houses and nearby perches for the birds. Serene Conservancy is supposed to be a bird sanctuary, so it is important to save those features that are important to the birds.

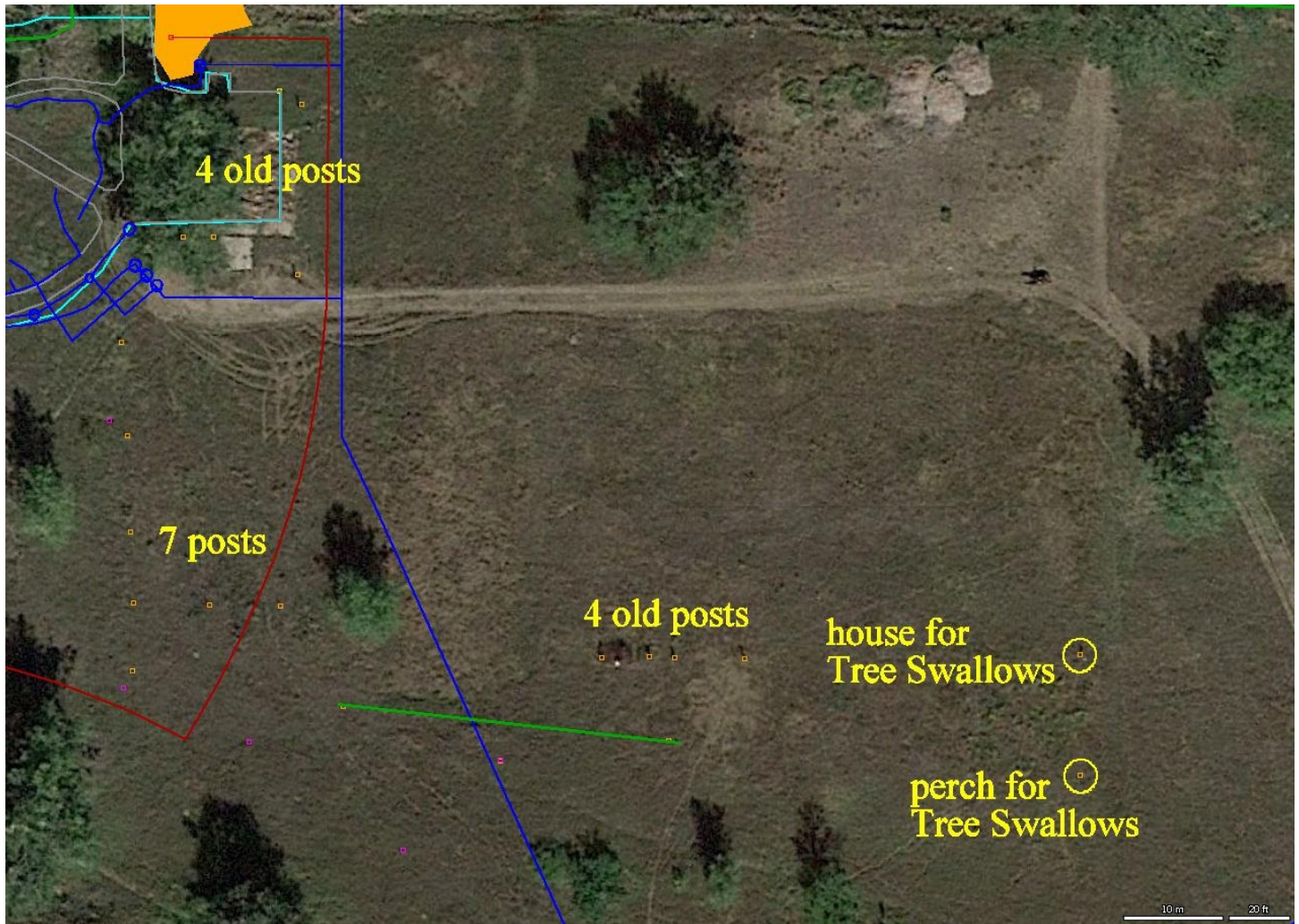


These marked posts should be saved for the birds.

These other wood posts are occasionally used by Robins, Flycatchers, Swallows, and others.

The birds will use them if not removed.

On a previous page is the image showing the boxed well heads. That image has 5 posts (small orange squares) that are not actively used by the birds. They could be removed or left standing. Only the irrigation plans (blue features which may not be properly located) might interfere with them.



central posts

In the central area are numerous posts. At the right side of the illustrated area are two posts that have always been used by Tree Swallows and should be saved. There is no proposed construction there anyway.

West of there are 4 large and old posts from a former fence line. They are not serving an important purpose but are not interfering with construction plans. It does not matter much if they are removed or left standing. That has also been a storage area for salvaged wire fencing. Repairs for the safety fencing have come from these supplies.

At the left side of the view are two lines of posts with a total of 7 small wooden posts. There is another post lying on the ground near one of them. Apart from occasional perches, these are not serving an important purpose and can be removed. Some must be removed for playground construction and for erection of the new rail fence.

In the picnic area, with the existing concrete pad, are 4 large and old posts. It is expected that all of them will be removed during construction.

## 6. Playground Area Hidden Items

The large sloping field south of the entrance pond has some hidden features. There are raised ridges in N-S orientation made of imported gravel. Troughs between them may have been used for gardening.





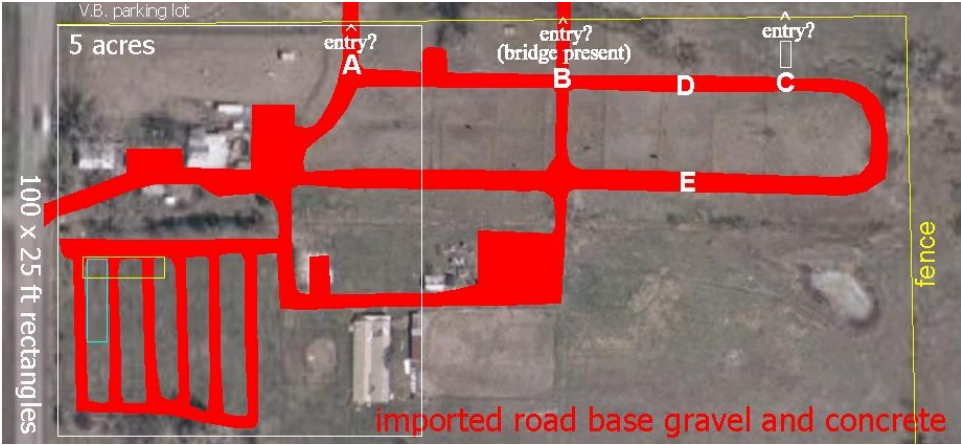
Playground area

The construction plans as drawn for the playground likely have it positioned about 5.5 meters (18 feet) too far north of the actual field locations. Rather than circling the large existing tree, a concrete pathway cuts through its location.

Along the axes of the troughs between the gravel ridges are pits shown by the magenta circles (with only crude GPS accuracy). The pits likely contain large stones, the remains of plastic plant buckets, and possible black cloth. These appear to be functioning as drains. If so, there may be hidden drainage pipes running N-S

between them, following the alignment of the troughs. In the upper right of this view there are pipes of different sizes that serve a drainage function. The construction plans do not notice the large drainage pipe, nor the large pipe (not shown here either) under the driveway that connects the entrance pond to the central drainage ditch. During construction the drainage of the playground area needs to be properly addressed. (There are more pits to the west of the illustrated area that will not be interfering with construction plans.)

**7. Gravel Trails Are Functioning as Levees for Flood Protection**



In the 1979 aerial photos of the property the tall ridge north of the new parking lot is not present. It was built to protect the former farm buildings from 100-year floods of Van Bibber Creek. The gravel trail loops are not present either. Page 4 of the construction plans indicates that the gravel trail materials are to be removed and disposed of. It is expected that they are about 8 to 12 inches thick of boulders, gravel, and

sand. They are wider than drawn. This illustration, previously drawn in 2007, shows in red all areas of imported gravel and concrete on an older aerial photo that shows the former farm buildings. Note that the southern loop has a huge area of gravel previously used for parking and not noted in the construction plans.

As previously communicated, the gravel trails with labels A,B,C,D,E functioned as levees during the 13 September 2013 flood. The official 100-year flood plain shown in blue in a next image is much wider than the area flooded in 2013, indicating that floods of the 2013 magnitude are much more frequent than 100 years.

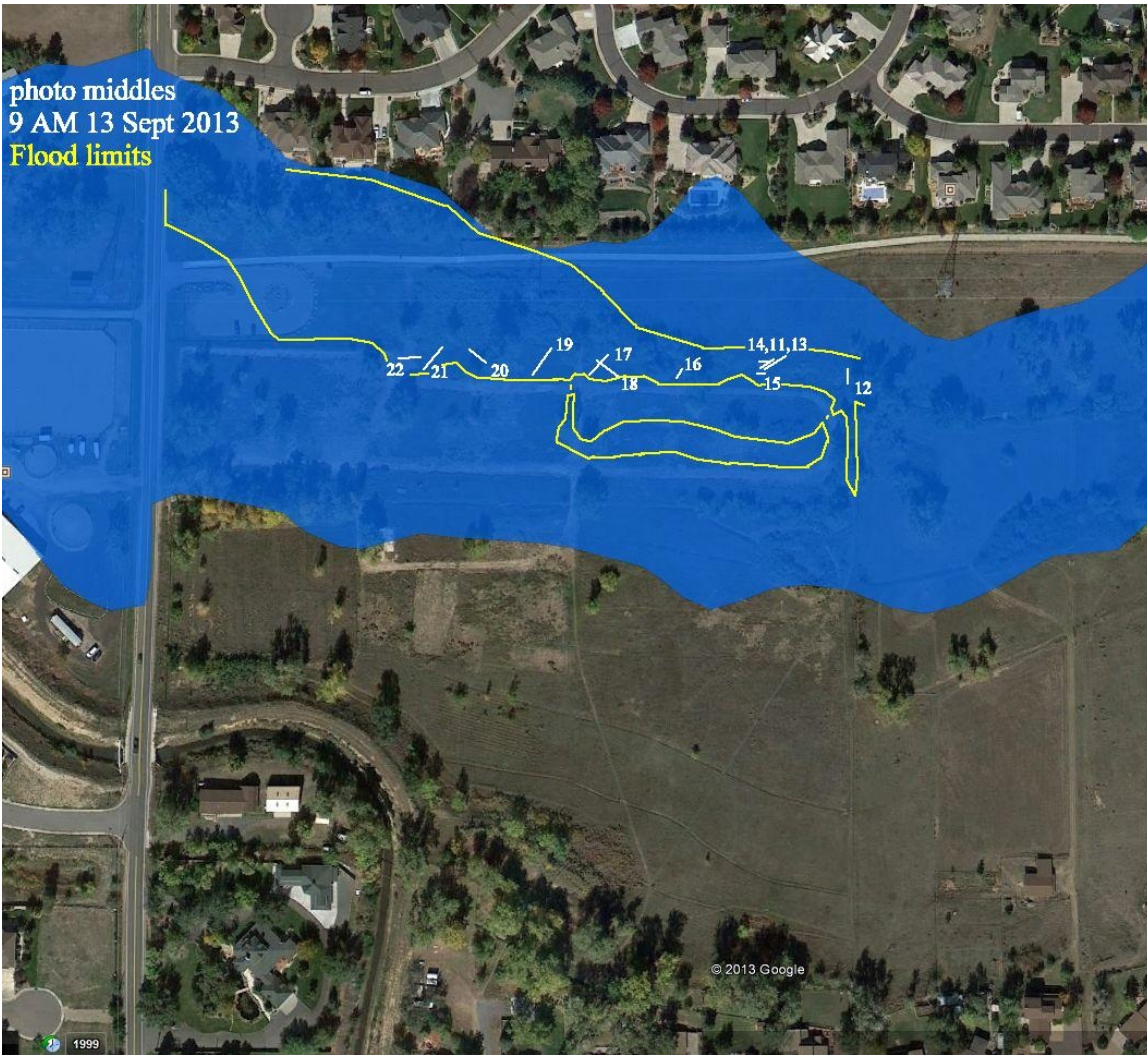
Next are a few of my photos of the 13 September 2013 flood. Frame numbers are shown on the following map.



21. Flood water arriving from old parking lot, position A.

17. Flood crossing gravel path at B.

14. Flood crossing grassy path at C.



100-year flood plain (blue) with extents of 13 September 2013 flooding, photo locations.

The photos were taken after the flood waters had reached their peak and were receding. The tall ridge north of what is now the new parking lot was the first barrier to the flood. Thereafter the northern part of the gravel trail functioned well as a levee, confining most of the water to its north.

It was a drainage pipe at the trail crossway that flowed backwards, allowing water to flood the interior of the eastern loop. The south part of the eastern loop likewise functioned as a levee. Otherwise the water would have continued to the drainage ditch in the middle of the

property that leads to the eastern pond. Removal of the gravel trail system will enable more frequent flooding of the lowlands of Serene Conservancy.

### 8. An Idea of Heresy?

Essentially all of the people (with whom I have talked) who are using the Serene Conservancy property for their walks actually enjoy it just as it is, with no further changes. So I have a proposal:

1. Build the picnic and playground areas but at corrected locations.
2. Do not make any of the other Construction Plan changes elsewhere.

The intent of the conservation easement was to restore the eastern 13 acres towards a near-natural habitat while providing access trails. That has been mostly accomplished. Continued maintenance might have costs of only a few hundred dollars per year.

3. Leave the gravel trails intact to serve as levees as well as walking paths. People and dogs like those loops.

4. The lack of construction scars on most of the property has the benefit of not promoting new noxious weed infestations.

5. The eastern pond in the lowlands can eventually be cleaned of trash and dead willows, making it more visually attractive like what has been done with the upper pond edges. Such work should not be done while birds are using that area. Now that weed control has created barren zones on the ridges around the pond, they can be seeded with Buffalo Grass and Blue Grama Grass, both appropriate for dry sunny clay conditions.

6. Completely stop the use of water from the Alford-Selman Lateral Ditch, even though Prospect has water rights for it. The valuable water can be used better elsewhere. The upper pond would then have minimal natural to no water in it. It will not be attractive as a swimming hole. As shown by Jeffco Open Space management, the Van Bibber valley needs no irrigation to maintain natural habitat. There would then be no disturbances in the slopes and lowlands for the irrigation system. The willow grove north of the upper pond has been expanding in recent years from increased water. Cutting off their water supply will stop that expansion and ultimately restore that area to prairie grassland. As the willows die back their dead branches can be removed.

7. The cattail swamp on the southern upland slope has been growing in size over the years and even now there is an increasing surface water flow beyond the margins of the cattails. This is not a natural environment for a cattail swamp. The increasing leakage of water from the Alford-Selman Lateral Ditch needs to be stopped. This can be done by inserting a large pipe along the ditch where the leakage is suspect. Prospect could subsidize the cost of this improvement. More water would then be available for users downstream of the leak. The cattail swamp would eventually die out and be replaced by prairie grassland.

These proposals will save the public lots of their tax money, for both construction and future maintenance costs. It will continue and promote their enjoyment of the property, in accord with the wishes of the previous owners.