Coyote Canyon Hydrology Report

Prepared for:
County of Santa Clara

September 2018
September 14, 2018

A REPORT PREPARED FOR:
County of Santa Clara

by

Zan Rubin
Hydrologist/Geomorphologist

Chelsea Neill
Hydrologist/Geomorphologist

Jonathan Owens
Principal Hydrologist

Balance Hydrologics, Inc.

© 2018 Balance Hydrologics, Inc.
Project Assignment: 217130

800 Bancroft Way, Suite 101 – Berkeley, California 94710-2251 – (510) 704-1000 – office@balancehydro.com
# TABLE OF CONTENTS

## 1  FIELD DATA COLLECTION METHODS
- 1.1 Watershed Delineation 1
- 1.2 Pond Extent, Duration, Depth 4
- 1.3 Field Observation (Seeps, Springs, etc.) 4
- 1.4 Topography and Hazards 5

## 2  RESULTS
- 2.1 Watersheds 7
- 2.2 Ponds 7
- 2.3 Pond 1/ Two Gates Pond 11
- 2.4 Pond 1/ Two Gates Pond Recommendations 11
- 2.5 Pond 2/ Shady Pond 11
- 2.6 Pond 2/ Shady Pond Recommendations 12
- 2.7 Pond 3/ Windmill Pond 12
- 2.8 Pond 3/ Windmill Pond Recommendations 12
- 2.9 Pond 4/ Rock Pond 12
- 2.10 Pond 4/ Rock Pond Recommendations 12
- 2.11 Pond 5/ Cattail Pond 13
- 2.12 Pond 5/ Cattail Pond Recommendations 13
- 2.13 Pond 6/ Mud Lake 13
- 2.14 Pond 7/ Bamboo Pond 14
- 2.15 Pond 7/ Bamboo Pond Recommendations 14
- 2.16 Pond 8/ Duck Pond 14
- 2.17 Pond 8/ Duck Pond Recommendations 14
- 2.18 Pond 9/ Highlands Pond 14
- 2.19 Pond 9/ Highlands Pond Recommendations 15
- 2.20 Pond 10/ Vemal Pool 15
- 2.21 Pond 10/ Vemal Pool Recommendations 15
- 2.22 Pond 11/ Wigeon Pond 15
- 2.23 Pond 11/ Wigeon Pond Recommendations 16
- 2.24 Pond 12/ Cabin Pond 16
- 2.25 Pond 13/ Coe Pond 16
- 2.26 Pond 14/ Upper Coral Pond 16
- 2.27 Pond 15/ Nesbit Pond 16
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.28</td>
<td>Pond 16/ Lower Coral Pond</td>
<td>16</td>
</tr>
<tr>
<td>2.29</td>
<td>General Pond Recommendations</td>
<td>17</td>
</tr>
<tr>
<td>2.30</td>
<td>Streams and Stream Crossings</td>
<td>17</td>
</tr>
<tr>
<td>2.31</td>
<td>General Road Recommendations</td>
<td>21</td>
</tr>
<tr>
<td>3</td>
<td>LIMITATIONS</td>
<td>22</td>
</tr>
</tbody>
</table>
LIST OF TABLES
Table B1        Coyote Canyon Key Pond Characteristics         8

LIST OF FIGURES
Figure B1       Watershed Areas                              2
Figure B2       Pond Hydrology                               3
Figure B3       Clogged or buried culvert inlets             18
Figure B4       Incision and erosion of road and downstream of culverts  19
Figure B5       Erosion Hazards                              20

ATTACHMENT
Attachment A    Supplementary Figures
1 FIELD DATA COLLECTION METHODS

Balance Hydrologics’ staff conducted field visits to the Coyote Canyon Property in spring of 2018 to document the hydrology of the site. During these visits, field hydrologists surveyed the preliminary trail options as well as 12 mapped ponds to the west of Coyote Creek but did not visit the four ponds to the east of Coyote Creek (due to limited accessibility and unlikely potential impacts due to limited anticipated public access). The ponds east of Coyote Creek were assessed remotely using aerial imagery and Geographic Information Systems (GIS).

1.1 Watershed Delineation

The main watershed areas within the property and sub-watersheds for 16 ponds were delineated using the Hydrology toolset in ArcGIS v 10.3 (Figure B1). The delineations were calculated from a USDA/NRCS 3m DEM (digital elevation model). Pond watershed areas were also delineated and verified in the field where possible (Figure B2).
Figure B1: Watershed Areas

Legend
- Coyote Canyon Boundaries
- Santa Clara County Parks
- Protected Lands
- Public Road
- State Highway
- Freeway
- Watershed Boundary

Watershed areas range from 6.32 to less than 0.01 square miles
Figure B2: Pond Hydrology

Legend
- Coyote Canyon Boundaries
- Santa Clara County Parks
- Protected Lands
- Public Road
- State Highway
- Freeway
- Pond watershed area

Pond watershed areas range from 1 to 96 acres
1.2 Pond Extent, Duration, Depth

Ponds were visited during the spring, when they were likely at the highest water elevation for the year (although WY 2018 was relatively dry). Pond area and depth at the time of visit, and the maximum potential pond depth were estimated using a stadia rod. During the site visit, the status of the channel inlet, the constructed impoundment berm, and the channel spillway or outlet were all evaluated. Additionally, following the field work, historic aerial photographs were analyzed to estimate an average pond hydroperiod\(^1\) for each pond (denoting which ponds were typically perennial and which dried during the summer), and noted any changes to the pond over time.

Perennial versus seasonal ponds are likely to have different flora and fauna associated with them, due to differences in soil, underlying geology, and water sources. To expand understanding of the ponds beyond limited observations, the hydroperiod is important in estimating the type of habitat each pond can support. This information is particularly useful for informing pond management decisions. For example, California red-legged frog (\textit{Rana draytonii}) is a federally listed threatened species which thrives in ponds which seasonally go dry. The non-native bullfrog (\textit{Rana catesbeiana}) requires ponded water year-round and are known to prey on, or compete with, California red-legged frog. Managing ponds to have a seasonal hydroperiod optimizes the habitat for California red-legged frog, by discouraging the breeding and growth of the bullfrogs.

It was beyond the scope of this project, but future work could include creating a series of historical aerial photographs for each pond that could be documented and archived for comparison to future condition. Additionally, ponds could be instrumented and continuously monitored to further analyze the pond hydrology. This information could be used in conjunction with historic aerial photographs to model pond hydroperiod and to monitor the impact of climate change on the ponds, which could also be used to inform management decisions regarding the habitat value of each pond.

1.3 Field Observation (Seeps, Springs, etc.)

During the field surveys, observations of seeps and springs and were investigated for evidence of water source(s) that might contribute to each pond. Additionally, specific conductance and temperature were measured at each pond. Specific conductance is

\(^1\)Average “hydroperiod” for a pond is the length of time a pond would be ponded in an average year. In this case, based on available imagery, ponds were assessed as either seasonal or perennial.
an electrical proxy for salinity, which can be used to differentiate ponds sourced from recent rainfall (low conductance) from ponds fed by longer-flow-path groundwater, seeps and springs (higher conductance).

1.4 Topography and Hazards

Maps of the site topography were produced using the USDA NRCS Digital Raster Graphic (DRG) in ArcGIS. Similarly, geologic maps were developed and used to evaluate landslide zones, faults, geology, and soils. During field visits mapped features were assessed, as were hazards that had not been previously mapped, such as erosion, headcuts, wet spots, faults, and landslides, or other erosional features or potential erosional issues on trails or surrounding ponds and streams. Erosion is a natural process, which can lead to an increase in sediment in streams and ponds. Excessive sediment can have a negative effect on aquatic organisms, as well as contribute to the filling in of ponds and reservoirs. Erosion along trails can occur from water moving down the compacted trail, causing rills and gullies, as well as moving across the trail at stream crossings, causing incision and muddy areas. Erosion along trails not only can increase the amount of sediment being contributed to channels but can also increase the amount of maintenance required to maintain trails.

Headcuts, also called knickpoints, are an abrupt vertical drop within channels with incision downstream. Headcuts typically migrate upstream as the vertical drop erodes causing further erosion and incision of the channel downstream. Building and maintaining trails across incised channels, or in areas with headcut migration, can be difficult.

Field hydrologists noted wet spots along the trail, which can be caused by water flowing down or across the trail, as previously mentioned, as well as from seeps and springs near the trail. Wet spots can cause further impact as people walk around these areas, which can lead to trail widening. They can also limit vehicle access during periods of wet weather. Ultimately, these areas lead to an increase in required trail maintenance.

Balance staff created maps of faults and looked for evidence of faults or fault activity in the field. Faults are often associated with steep slopes above and a less steep bench or pond along the fault. Ponds are often found along faults, because the associated fractures provide a source of groundwater. Faults are also often associated with landslides, which can have unstable ground and be the source of mobile sediment. Both
faults and landslides can also be associated with finer-grained soils, which can serve to slow water drainage and pond water more than other locations.

Field hydrologists also looked for recently activated landslides, which can be a major source of sediment. Older landslide areas can often be identified by hummocky topography and can also be associated with seeps, springs, and ponds.
2 RESULTS

2.1 Watersheds

The main watershed areas within Coyote Canyon are shown in Figure B1, with the respective watershed areas labeled. Balance staff delineated the major tributaries to Coyote Creek as well as the main streams flowing out of the property on the western border.

2.2 Ponds

The location and watershed delineation for each pond is shown in Figure B2 and key observations presented in Table B1. Photos of each pond can be seen in in Attachment “Supplementary Figures”. Ponds are indicated by both a number and by their names given by the previous landowner to aid in listing and describing them.
<table>
<thead>
<tr>
<th>Pond Name</th>
<th>Watershed Area (Acres)</th>
<th>Approximate Area (when pond is full) (ft²)</th>
<th>Typical Pond Hydrology</th>
<th>Date of Visit</th>
<th>Depth Estimate</th>
<th>Water Temperature (°C)</th>
<th>Conductance at field temp. (µmhos/cm)</th>
<th>Specific Conductance at 25°C (us)</th>
<th>Remarks</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pond 1/ Two Gates Pond</td>
<td>32.8</td>
<td>3,000</td>
<td>perennial most years</td>
<td>3/26/2018</td>
<td>&gt; 5</td>
<td>19</td>
<td>367</td>
<td>413</td>
<td>good/ outlet issues</td>
<td>re-route outflow back to the natural channel, lengthening the channel; re-route the trail around low, wet, muddy area to reduce monitoring and support wetland vegetation.</td>
</tr>
<tr>
<td>Pond 2/ Shady Pond</td>
<td>23.7</td>
<td>5,625</td>
<td>perennial most years</td>
<td>3/26/2018</td>
<td>&gt; 3</td>
<td>18.2</td>
<td>180</td>
<td>208</td>
<td>threatened</td>
<td>1. excavate the spillway to be lower than the berm and repair the erosion in the berm. 2. create an outlet in the berm where the erosion is occurring and rock the new spillway to prevent future erosion. 3. remove pond</td>
</tr>
<tr>
<td>Pond 3/ Windmill Pond</td>
<td>95.9</td>
<td>1,250</td>
<td>seasonal</td>
<td>3/26/2018</td>
<td>4</td>
<td>20.3</td>
<td>161</td>
<td>178</td>
<td>no berm</td>
<td>...</td>
</tr>
<tr>
<td>Pond 4/ Rock Pond</td>
<td>3.9</td>
<td>2,900</td>
<td>likely perennial</td>
<td>4/18/2018</td>
<td>&lt; 3</td>
<td>12.4</td>
<td>450</td>
<td>593</td>
<td>no berm</td>
<td>If the pond is to be maintained and continues to be fed by pipes then the pond outlet should be rocked to minimize erosion. It may be beneficial to break up the grouted rock walls and naturalize/ vegetate banks.</td>
</tr>
<tr>
<td>Pond 5/ Cattail Pond</td>
<td>4.6</td>
<td>17,300</td>
<td>perennial</td>
<td>4/18/2018</td>
<td>&lt; 4</td>
<td>11.2</td>
<td>439</td>
<td>597</td>
<td>good</td>
<td>The pond and berm are in good condition, could put rock at culvert outlet to prevent future incision; monitor seepage out of pond.</td>
</tr>
<tr>
<td>Pond Name</td>
<td>Watershed Area (Acres)</td>
<td>Appropriate Area (when pond is full)</td>
<td>Typical Pond Hydrology</td>
<td>Date of Visit</td>
<td>Depth Estimate (ft)</td>
<td>Water Temperature (°C)</td>
<td>Conductance at field temp. (µmhos/cm)</td>
<td>Specific Conductance at 25°C</td>
<td>Berm Status</td>
<td>Remarks</td>
</tr>
<tr>
<td>--------------</td>
<td>------------------------</td>
<td>--------------------------------------</td>
<td>------------------------</td>
<td>------------------------</td>
<td>---------------------</td>
<td>------------------------</td>
<td>------------------------------------------</td>
<td>-------------------------------</td>
<td>-------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Pond 6/ Mud Lake</td>
<td>10.7</td>
<td>19,000</td>
<td>perennial in some years</td>
<td>3/26/2018</td>
<td>&gt;3</td>
<td>17.8</td>
<td>123</td>
<td>143</td>
<td>good</td>
<td>lake is turbid, light, bright brown in color, typical high water</td>
</tr>
<tr>
<td>Pond 7/ Bamboo Pond</td>
<td>2.5</td>
<td>800</td>
<td>seasonal</td>
<td>4/18/2018</td>
<td>4</td>
<td>14.4</td>
<td>549</td>
<td>687</td>
<td>good</td>
<td>area to east of pond appears to be frequently inundated with water; all</td>
</tr>
<tr>
<td>Pond 8/ Duck Pond</td>
<td>13.0</td>
<td>3,500</td>
<td>unknown</td>
<td>3/26/2018</td>
<td>2-3</td>
<td>11.4</td>
<td>359</td>
<td>486</td>
<td>threatened</td>
<td>pond is full of cat tail and covered in red algae, outlet is a buried</td>
</tr>
<tr>
<td>Pond 9/ Highlands Pond</td>
<td>34.8</td>
<td>2,000</td>
<td>seasonal</td>
<td>3/26/2018</td>
<td>4</td>
<td>14.1</td>
<td>138</td>
<td>174</td>
<td>good</td>
<td>pond is turbid and muddy with less than 4&quot; visibility, delta sediment</td>
</tr>
<tr>
<td>Pond 10/ Vernal Pool</td>
<td>7.3</td>
<td>11,250</td>
<td>seasonal</td>
<td>3/26/2018</td>
<td>0.1</td>
<td>7.6</td>
<td>56</td>
<td>84</td>
<td>no berm</td>
<td>the high-water line is approximately 18 inches deep and approximately 75</td>
</tr>
<tr>
<td>Pond 11/ Wigeon Pond</td>
<td>#N/A</td>
<td>51,500</td>
<td>perennial</td>
<td>3/26/2018</td>
<td>&gt;5</td>
<td>11.2</td>
<td>86</td>
<td>117</td>
<td>good</td>
<td>pond spills to east down the road; pond is 2 ft below the spillway</td>
</tr>
<tr>
<td>Pond Name</td>
<td>Watershed Area (Acres)</td>
<td>Approximate Pond Area (ft²)</td>
<td>Typical Pond Hydrology</td>
<td>Date of Visit</td>
<td>Depth Estimate</td>
<td>Water Temperature (°C)</td>
<td>Conductance at field temp. (µmhos/ cm)</td>
<td>Specific Conductance at 25°C (µs)</td>
<td>Berm Status</td>
<td>Remarks</td>
</tr>
<tr>
<td>-------------------</td>
<td>-----------------------</td>
<td>----------------------------</td>
<td>------------------------</td>
<td>---------------</td>
<td>----------------</td>
<td>------------------------</td>
<td>----------------------------------------</td>
<td>---------------------------------</td>
<td>------------</td>
<td>---------</td>
</tr>
<tr>
<td>Pond 12/ Cabin Pond</td>
<td>N/A</td>
<td>1,500</td>
<td>seasonal</td>
<td>4/18/2018</td>
<td>2</td>
<td>17.9</td>
<td>193</td>
<td>224</td>
<td>good</td>
<td>ditch starts near cabin and ends at pond, may have been used to capture runoff from hillside, but no obvious signs of recent flow through ditch; water is light brown in color; pipe coming into pond appears to be stuck in mud, small spillway appears to be rarely activated; when it does spill flows to road, but there are no signs of erosion; berm is approximately 4 ft higher than water surface; pipe into trough near cabin has approximately 1-2 gpm spilling, SCT of water is 598 µmhos/ cm @ 16.1°C and 721 us @ 25°C</td>
</tr>
<tr>
<td>Pond 13/ Coe Pond</td>
<td>4.4</td>
<td>2,700</td>
<td>perennial</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>unknown</td>
<td>Pond was not visited</td>
</tr>
<tr>
<td>Pond 14/ Upper Corral Pond</td>
<td>12.3</td>
<td>8,000</td>
<td>perennial</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>unknown</td>
<td>Pond was not visited</td>
</tr>
<tr>
<td>Pond 15/ Nesbit Pond</td>
<td>1.0</td>
<td>200</td>
<td>seasonal</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>unknown</td>
<td>Pond was not visited. There may be a headcut downstream threatening the berm</td>
</tr>
<tr>
<td>Pond 16/ Lower Corral Pond</td>
<td>3.3</td>
<td>450</td>
<td>seasonal</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>unknown</td>
<td>Pond was not visited; may be fed by seeps</td>
</tr>
</tbody>
</table>
2.3 Pond 1/ Two Gates Pond

The outlet channel at Two Gates Pond is incised and there is a headcut in the outlet channel. The outlet-channel headcut may be caused by the culvert at the downstream end of the spillway, which is below the channel grade. The channel just upstream of the culvert has been excavated to allow water to flow through the culvert. The inlet channel and the berm are in good condition and there is no notable vegetation around the pond. The ranch road downstream of the pond was muddy and pockmarked with deep cow prints, for approximately 90 feet along the road. Two Gates Pond is located near a fault (USGS, 2018), which likely contributes to the perennial nature of the pond through seeps and springs. One of the underlying causes of erosion and future trail-maintenance trouble in the area is the confluence of roads, trails, and creeks all in the topographic low area downslope from the Two Gates Pond. In addition to local drainage keeping the topographic low wet and muddy, it is likely that seepage out of the pond contributes to the muddy road intersection.

2.4 Pond 1/ Two Gates Pond Recommendations

The spillway channel could be re-routed back to the natural channel downstream of the berm, which would lengthen the channel and decrease the slope, reducing erosion potential and increasing habitat value. Alternatively, rock could be added to the spillway channel at the pond outlet to minimize erosion. The road-culvert crossing downstream of the pond is also in need of repair, and the culvert elevation should match the upstream channel gradient. Re-routing roads and trails around the topographic low, or creating an elevated boardwalk or turnpike could likely increase the habitat value of a seasonally wet area and decrease the need for ongoing maintenance.

2.5 Pond 2/ Shady Pond

The Shady Pond berm is imminently at risk of failure with a headcut measured to be 7 feet high and 6 feet wide. The existing spillway elevation is higher than the berm, which has contributed to the berm erosion. Pond spilling is uncontrolled- over the berm into the headcut, rather than out through the excavated spillway. The inlet channel and the constructed spillway and outlet are in good condition, through the spill channel appears to be rarely active. The pond has a drainage channel upstream and is perennially wet most years. There is no notable aquatic vegetation around the pond.
2.6 Pond 2/ Shady Pond Recommendations

The berm needs immediate maintenance or decommissioning. There are three options to address the eroding berm. The first is to excavate the existing spillway so that the outlet is lower in elevation than the berm and to repair the erosion in the berm. The second is to create a new spillway outlet in the berm where the current erosion is occurring; this new spillway would need to be repaired and lined with rock to prevent the headcut from re-forming in the future. Third, the berm (and therefore pond) could be removed entirely (or lowered), returning the pond to a seasonal creek or a creek with a wide wetland area.

2.7 Pond 3/ Windmill Pond

Based on field observations it is unclear whether Windmill pond is primarily fed from infrastructure (piped from a spring, or leaking pipe) or from local drainage. Windmill Pond does not have an obvious berm and the channel inlet is through a culvert, which appears to be in good condition. The pond goes dry during most years and does not have any notable aquatic vegetation.

2.8 Pond 3/ Windmill Pond Recommendations

Further information about the ecological goals, the historical context, and the pond infrastructure is needed to make recommendations about the pond management here.

2.9 Pond 4/ Rock Pond

Rock Pond is fed by a pipe upstream of the pond and likely has had water perennially, depending on operations and management. Most, if not all, of the source water is assumed to come from the pipes. The pond is divided into three distinct sections. The upper section is dammed by a downed tree. The middle section is lined with a grouted rock wall which spills over a notch into the lower section, which is also lined with rock. Water flows out of the lowest pond over a muddy area to an incised channel downstream. Additional water leaves the pond through a pipe that also flows to the channel downstream. Many irises are growing at the upstream pipe outlet area, which feeds the pond. Additionally, some cattails are growing at the upstream end of the pond.

2.10 Pond 4/ Rock Pond Recommendations

Future pond maintenance will largely depend on the pond infrastructure and whether the pond continues to be fed by pipes. If the pond is maintained, then the pond outlet should be re-designed to prevent erosion at the spillway.
It may also be beneficial to break up the grouted rock edges of the pond to allow for vegetation and increased ecological functions and values.

2.11 Pond 5/ Cattail Pond

Cattail Pond is approximately 325 ft downstream from Rock Pond and appears to be primarily fed by water flowing from Rock Pond. The pond is perennial, likely because most, if not all, of the water comes from pipes upstream of Rock Pond. There is a fault running though the pond (USGS, 2018), which could also contribute to the perennial nature of the pond. Most of the pond berm and outlet channel appear to be in good shape, but water flowing out of the pond travels through the berm as seepage under the outlet culvert. The pond is full of cattail, with a small zone of open water in the center. Based on historic air photos, the cattails have only grown in the pond within the past few years, perhaps due to changing grazing practices or recent climate patterns.

2.12 Pond 5/ Cattail Pond Recommendations

Seepage through the berm should be fixed, perhaps by reinstalling the outlet culvert at a deeper elevation and should continue to be closely monitored. Pond maintenance will likely depend upon the pond management decisions and whether the pond continues to be fed by pipes. It may be beneficial to rock\(^2\) the culvert outlet to prevent future incision downstream. For habitat enhancement, the road (currently on the west side of the pond) could be re-routed around the pond (on the berm), to create a more dispersed wetland area feeding the lower pond.

2.13 Pond 6/ Mud Lake

Mud Lake is in good condition and the pond appears to rarely spill. The outlet is through a culvert placed towards the top of the berm and both the culvert and the berm are in good condition. There is no obvious inlet channel to the pond and field hydrologists estimated that it is fed primarily by surface and shallow subsurface runoff. There are water tanks upslope of the pond, which may by contributing to the pond, but no evidence of infrastructure feeding the pond was found during the field assessment. Mud Lake is perennially ponded in some years and has little vegetation. In general, the pond appears to be in good condition and does not currently appear to require any maintenance.

\(^2\) ‘Rocking’ refers to placing several layers of rocks (sometimes with filter fabric) beneath a culvert outlet. The rocks dissipate the erosive force of water and prevent incision and erosion at the outlet and downstream of the culvert.
2.14 Pond 7/ Bamboo Pond

The Bamboo Pond inlet is uncontrolled and is muddy with water flowing across the trail. There was standing water in the area to the east of the pond, which appears to be frequently inundated with water based on the type of vegetation growing in the area. The pond outlet appears to go around the berm, but water may also spill to the south-east through the bamboo area. The outlet area appears to be in good condition. Bamboo Pond is seasonal, and water may have historically been diverted to feed bamboo at times. The mapped fault trace disappears under mapped landslide deposits in the area (USGS, 2018).

2.15 Pond 7/ Bamboo Pond Recommendations

The inlet area could be rocked to create a hardened trail ford, to prevent erosion and limit the amount of mud on the trail at the stream crossing. Additionally, a boardwalk or low bridge could be helpful through the inlet area.

2.16 Pond 8/ Duck Pond

The berm at Duck Pond is threatened and the earth around the culvert outlet has been recently eroded. The channel downstream of the outlet is eroded and incised. Duck Pond is fed by infrastructure upslope of the pond and the inlet area is in good condition. The pond is full of cattail and red algae. The vegetation within the pond has grown within the past few years; prior to 2014, the area around the pond appears to have been bare earth (based on air photos). Historic air photos suggest there may have been a second water source feeding the pond, but there is no recent evidence of this water source either from air photos or from field observations.

2.17 Pond 8/ Duck Pond Recommendations

The berm is threatened and in need of near-term maintenance. To avoid sudden failure, the berm and culvert should be repaired, and the culvert outlet needs to be rocked to prevent future erosion. Alternately, the berm and pond could be decommissioned.

2.18 Pond 9/ Highlands Pond

There are seeps upstream of Highlands Pond and there is active erosion and incision on the two upstream channels feeding the pond. There has been fine sediment deposition filling the pond from the inlet channels. The upstream incision appears to be active, so the pond will likely continue to fill and lose capacity in coming years. It is possible that the
pond may fill with enough sediment to result in over-topping the berm. The spillway channel has a large knickpoint approximately 120 feet downstream of the spillway, which is 10-15 feet deep with a severely eroded channel downstream. Highlands Pond is seasonal and does not retain water for much of the year. In general, the pond may have limited habitat value due to the absence of vegetation and short amount of time that it holds water.

2.19 Pond 9/ Highlands Pond Recommendations

If the pond is to be maintained, treatments to rock the spillway to minimize erosion and to stabilize upstream incision should be implemented. Depending on habitat and management objectives, dredging the pond to increase the hydroperiod could be considered.

2.20 Pond 10/ Vernal Pool

Vernal Pool does not have a constructed berm and likely only spills during very wet years towards the southwest. The vernal pool is approximately 75 feet by 150 feet (approximately 11,250 square feet) when it is full. Field hydrologists observed a high-water line approximately 18 inches deep, which is still below the elevation at which the pool would spill. Field hydrologists estimated that the pool would spill when it is approximately 2 ft deep, which would increase the area to approximately 20,000 square feet. No evidence of the pond spilling in recent years was observed.

2.21 Pond 10/ Vernal Pool Recommendations

The proposed trail is near Vernal Pool and should be re-routed to higher ground along the watershed boundary to the east to keep the trail outside of the small watershed contributing to the vernal pool. The proximity of trails to vernal pools can have substantial impacts on water quality and greatly impact aquatic life.

2.22 Pond 11/ Wigeon Pond

Wigeon Pond is in good condition. The berm is intact and appears to only spill on rare events. When it does spill, water flows down the road to the east. There is no sign of erosion downstream along the road; the road is not muddy and there is no evidence of recent flow Wigeon pond is perennially wet in most years and may be fed by seeps, as well as surface runoff. There is no aquatic vegetation growing in the pond.
2.23 Pond 11/ Wigeon Pond Recommendations

In general, the pond and the berm are in good condition. The road where water spills should continue to be monitored for erosion and headcuts.

2.24 Pond 12/ Cabin Pond

Cabin Pond is in good condition. The pond berm is intact, and the small spillway appears to be rarely activated. The pond may be fed by a pipe and from infrastructure upslope, but the water source is not apparent from field observations. The ditch that feeds the pond starts near the cabin and does not appear to have had recent flow through it. When water does spill from the pond it would flow down the road, but there are no signs of erosion. In September 2017, the area around the corral near the pond was inundated with water, but previous photos do not show inundation of the corral area, suggesting a pipe may have leaked or a change in diversion infrastructure may have occurred there. Cabin Pond is seasonal most years and does not have any notable aquatic vegetation.

The following ponds were not visited, the information is obtained remotely via aerial photographs and through GIS:

2.25 Pond 13/ Coe Pond

Coe Pond is perennially wet in most years and has an average inundation area of 2,700 square feet.

2.26 Pond 14/ Upper Corral Pond

Upper Corral Pond is perennially wet in most years.

2.27 Pond 15/ Nesbit Pond

Nesbit Pond is seasonal, drying up in most years and was not visited during the site visits. Aerial photograph interpretation indicates there may be a headcut downstream.

2.28 Pond 16/ Lower Corral Pond

Lower Corral Pond is very small and appears to be seasonal, drying in most years, but is difficult to determine due to vegetation growth obscuring interpretation of aerial imagery. There may be seeps in the area feeding the pond.
2.29 General Pond Recommendations

- Climate change is predicted to increase the frequency and intensity of very wet years and very dry years which could rapidly change the status and erosion of many of the pond spillways and berms.

- It could be beneficial to fence cows out of portions of- or entirely from-some ponds to increase vegetation and cover for species such as California red-legged frog.

2.30 Streams and Stream Crossings

Many of the streams are incised at road crossings, particularly downstream of the crossings. Some of the culverts appear to be under-sized and clogged with sediment, with obvious signs of water moving across the road rather than through the culvert. In many locations, the water movement across the road is causing the road to erode. Figure B3 and B4 show images of buried culvert inlets and erosion and incision at stream crossings. The location of the photo points can be seen in Figure B5. Field Hydrologists observed multiple partially-buried culvert inlets, which may be the result of the culvert not being placed at a low enough elevation, the culvert not having enough slope to convey sediment, or the culvert being too small. The Coyote Canyon property is situated in a dynamic landscape and stream crossings should be planned accordingly. Channel segments that appear stable are likely to experience episodes of sedimentation and incision over the next decades. Proposed trail alignments in general, and stream crossings in particular, should consider terrain and hydrologic processes during the planning process.
Figure B3: Incision and erosion of road and downstream of culverts, Coyote Canyon, Santa Clara County, CA
The location of each photo (A-D) can be seen in Figure B5.

Source: Balance Staff April, 2018
© 2018 Balance Hydrologics, Inc.
Figure B4: Clogged or buried culvert inlets, Coyote Canyon
Santa Clara County, CA The location of each photo (A-D) can be seen in Figure B5.

Source: Balance Staff April, 2018

© 2018 Balance Hydrologics, Inc.
Figure B5: Erosion Hazards

Coyote Dam Staging Area & Trailhead

COYOTE CANYON

HENRY W. COE STATE PARK

MORGAN HILL

Dunne Avenue
Foothill Avenue
Maple Avenue
Carey Avenue

Recently activated landslides

Moderate incidence
High incidence
Low incidence

High susceptibility, moderate incidence
High susceptibility, low incidence
Moderate susceptibility, low incidence

Culvert outlet labels refer to photos in Figure 5.
Culvert inlet labels refer to photos in Figure 6.

Legend
- Coyote Canyon Boundaries
- Santa Clara County Parks
- Protected Lands
- Public Road
- State Highway
- Freeway
- Fault
- Quaternary hillslope deposit
- Culvert outlet photo location
- Culvert inlet photo location

Landslide Incidence and Susceptibility
- High incidence
- High susceptibility, moderate incidence
- High susceptibility, low incidence
- Moderate incidence
- Moderate susceptibility, low incidence
- Low incidence
- No data

Culvert outlet labels refer to photos in Figure 5.
Culvert inlet labels refer to photos in Figure 6.

U.S. Geological Survey (USGS)

Balance Hydrologics, Inc.
2.31 General Road Recommendations

- Minimize the amount of flow on the road that drains to the channel. Utilize outboard slopes on the road to disperse water so that it is not concentrated. Potential realignments of the road and trail network should be considered in the future Master Plan process to avoid problem areas and minimize the extent to which they dip down towards stream crossings to limit concentrating runoff into the channel network from these compacted surfaces, although a "critical dip" should still be maintained in the immediate location of a stream crossing\(^3\). If crossings show evidence of water flowing across them, the road or trail should be rocked in the immediate vicinity of the crossing.

- Install rolling dips and/or water bars on steep sections of trail or road, particularly as the trail approaches stream crossings. The hard-compacted road surfaces concentrate run-off. Dispersing the water off roads in many locations will promote infiltration.

- Fence cattle out of gullies to encourage vegetation establishment and limit soil detachment and compaction.

- Replace buried and partially-buried culverts with a larger culvert and at a steeper slope to transport sediment. The elevation of the culvert should match the elevation of the upstream channel gradient.

- Place rock under culvert outlets to minimize erosion and headcuts. Rocks should be a variety of sizes (well-graded) to dissipate erosive flow. Rocks that are too uniform in size, or too large, may allow water to scour underneath placed rocks.

---

\(^3\) A "critical dip" means that a water course crosses a road or trail at a low point in the road or trail, so that if a culvert clogs and water flows onto the road, the water flows across the road back into the water course, rather than being captured and diverted along the road or trail.
3 LIMITATIONS

It should be recognized that interpretation and evaluation of flow, subsurface conditions, groundwater, and other physical factors affecting channel and hillslope stability is a difficult and inexact art. Judgment leading to conclusions and recommendations are generally made with an incomplete knowledge of the conditions present. More extensive studies, including additional hydrologic and engineering investigations can reduce the inherent uncertainties associated with such studies.
Pond 1/ Two Gates Pond, Coyote Canyon, Santa Clara County, CA Channel outlet is incised and has a headcut (A); culvert inlet is below grade at the end of the spillway (looking up spillway channel) (B); downstream of berm road intersection is muddy (C).
Pond 2/ Shady Pond, Coyote Canyon, Santa Clara County, CA Looking upstream (A); headcut in berm is approximately 7 ft tall (B).
Pond 3/ Windmill Pond, Coyote Canyon, Santa Clara County, CA Looking downstream at pond (A); culvert inlet to pond (looking upstream) (B).
Pond 4/ Rock Pond, Coyote Canyon, Santa Clara County, CA Upstream section of pond (looking downstream) (A); Lower and middle sections of pond are lined with grouted rock wall (looking upstream) (B); pond outlet is not maintained (C); additional flow from pond is through pipe to downstream channel (D).
Pond 5/ Rock Pond, Coyote Canyon, Santa Clara County, CA Pond is full of cattail with a small clearing in the middle (A); channel from Rock Pond spills to Cattail Pond (looking upstream) (B).
Pond 6/ Mud Lake, Coyote Canyon, Santa Clara County, CA There is no obvious inlet channel to Mud Lake (A); culvert outlet is approximately 4-5 ft higher than water level during visit and water appears to rarely spill through culvert (B).
Pond 7/ Bamboo Pond, Coyote Canyon, Santa Clara County, CA Area adjacent to pond is frequently inundated with water (A); inlet channel has eroded across trail (looking upstream) (B)
Pond 8/ Duck Pond, Coyote Canyon, Santa Clara County, CA Pond is full of cattail and algae and is fed by pipes and infrastructure upslope (A); outlet culvert and berm has been recently eroded (B).
Pond 9/ Highlands Pond, Coyote Canyon, Santa Clara County, CA Sediment has been deposited at the channel inlet (A); the spillway channel has a 10-15 ft deep knickpoint approximately 120 ft downstream from the pond (B).
There was approximately 0.1 ft of standing water in the pool during the site visit and the high-water line is approximately 18 inches deep.
Pond 11/ Wigeon Pond, Coyote Canyon, Santa Clara County, CA Pond berm is intact and channel spills down road to east (at end of berm in photo) when it does spill (A); channel inlet drains hills to south (B).
Pond 12/ Cabin Pond, Coyote Canyon, Santa Clara County, CA Pond spills down to road, but spillway appears to be infrequently activated (A); inlet channel is a ditch along the slope (photo is looking up channel) (B).