March 7, 2022 Project No: 21-3654

Acorn Group
Sunset Two Properties Ltd., Box 2010
Kelowna, BC, V1X 4K5
Attention: James Kay

Subject: Environmental Management Plan for the installation of one new culvert, and upgrades to three existing culvert crossings over Rockface Creek, within the Regional District of Central Okanagan, BC.

1.0 INTRODUCTION

Ecoscape Environmental Consultants Ltd. (Ecoscape) was retained by the Acorn Group (Acorn) to prepare an Environmental Management Plan (EMP) to for a proposed installation of an open bottom arch culvert across Rockface Creek as part of the larger proposed Sunset Ranch residential subdivision development, Kelowna within the Regional District of Central Okanagan (RDCO), BC (subject property, **Figure 1**). In addition, upgrades to three (3) existing culverts are proposed, two (2) across Rockface Creek and one across the Rockface Creek tributary. The first two, at the southern extension of Sunset Ranch Drive and at the southerly extension of Trickle Creek Drive, will see the existing culverts removed, and will be replaced utilizing the same general arch span design as the new installation. The third proposed culvert upgrade, crossing the southern tributary of Rockface Creek, will be removed, and subsequently replaced by reusing the twin culvert from Sunset Drive.

To accompany the culvert installations and upgrades, several stormwater discharge locations have been proposed. Two (2) outfalls are proposed in stage 6, with one discharging to the tributary of Rockface Creek and one to Rockface Creek. The two (2) outfalls in stage 4.3 will also discharge to both Rockface Creek and the Rockface Creek tributary. Locations of each stormwater discharge can be seen depicted on Figure 2, and Appendix D. This EMP will be used for the submission of a *Water Sustainability Act* (WSA) Section 11 permit and encompasses the installation of the additional culvert installation, removal and upgrades to the existing culverts, and the associated stormwater discharges.

Ecoscape assumes that the proposed works can be completed under a *Water Sustainability Act* Section 11 Notification; however, Ecoscape acknowledges that the Province has jurisdictional authority to determine if the proposed works will occur under Notification or Approval, and our interpretation may vary with that of the Province.

The purpose of this report is to address potential environmental impacts of the proposed works and outline the existing conditions of the site. This report also provides an assessment of potentially existing terrestrial resource values, the potential for rare and/or endangered species and habitats, and recommendations where appropriate to maintain and/or improve the natural integrity of existing ecological communities.

2.0 PROPOSED WORKS

The proposed works are located within the proposed residential subdivision developments of Sunset Ranch Stages 4 and 6 at 5101 Upper Booth Road South (PID: 027-168-158) and Lot 9 Anderson Road (PID: 025-561-529), Kelowna, BC within the RDCO (subject properties; site location, Figure 1) and construction will involve the following:

1. Construction of an Armtec MiniSpan II 3350m span arch culvert with 152 mm x 51 mm corrugations and 400 mm x 200 mm concrete footings spanning 3.35 m across Rockface Creek at the southerly extension of Seminole Road. Riprap or sandbag head walls are proposed for erosion protection at the inlet. The cover over the culvert will be greater than 0.60 m and the culvert has been designed so that it can pass a 1:200 storm event (**Appendix B**).
2. Removal of two 600 mm diameter CSP culverts at the southerly extension of Sunset Ranch Drive across Rockface Creek, and replacement with the aforementioned span arch culvert design.
3. Removal of the existing 400 mm culvert crossing Rockface Creek at the southerly extension of Trickle Creek Drive and replacement with the same arch culvert design as described above.
4. Removal of 400 mm culvert from across the southern tributary of Rockface Creek and replacement using the twin 600 mm CSP culverts.
5. Four outfalls for the discharge of stormwater are proposed within stage 6 (**Appendix C**) and stage 4.3 (**Figure 2; Appendix D**). Two (2) outfalls are proposed in stage 6, with one discharging to the tributary of Rockface Creek and one to Rockface Creek itself. The two (2) outfalls in stage 4.3 will also discharge to both Rockface Creek, and to the Rockface Creek tributary.

The purpose of these 4 culvert installations/modifications is to facilitate road extensions within the proposed development. To achieve this, the following equipment will be utilized:

- Excavators;
- A front-end loader;
- Dump trucks;
- Compactors; and

- Graders

As the proposed span arch culvert design is intended to span over the width of the watercourse, direct disturbance to the stream bed itself should be minimal. Due to the ephemeral nature of the Rockface Creek tributary and general lack of flow, impacts during the twin culvert installation can be mitigated. Culvert installations and stormwater outfall discharge locations have been depicted in **Figure 2**, and the design of the proposed arch culverts is provided in **Appendix B**, with engineering civil designs and servicing brief included in **Appendix C** for phase 6.0, and the servicing brief for phase 4.3 and 4.4 is included in **Appendix D**.

The focus of this document is to provide Best Management Practices (BMPs) to be followed during the proposed works. If the mitigation measures and BMPs presented herein are adhered to, then the proposed works presents a low risk to aquatic, riparian and terrestrial resource values.

3.0 AQUATIC AND RIPARIAN HABITAT

A site visit was conducted on March 12, 2021 by Scott Sanford, B.Sc., R.P.Bio and Leanne McDonald, B.Sc., R.P.Bio., P.Ag., with Ecoscape to document the existing site conditions and identify sensitive environmental features.

Native vegetation adjacent to the location of the proposed works included Douglas-fir (*Pseudotsuga menziesii*, Douglas maple (*Acer glabrum*), common snowberry (*Symphoricarpos albus*), tall Oregon grape (*Berberis aquifolium*), black cottonwood (*Populus trichocarpa*), Saskatoon (*Amelanchier alnifolia*), trembling aspen (*Populus tremuloides*), red-osier dogwood (*Cornus sericea*), water birch (*Betula occidentalis*), sitka alder (*Alnus viridis*), rose (*Rosa* sp.) mock orange (*Philadelphus lewisii*) and horsetail (*Equisetum* sp.). In general, the riparian area of Rockface Creek is described as a mature, natural broadleaf forest with heavy cover, overhanging vegetation and abundant large woody debris. Site photos are included in **Appendix E**.

A Fish Inventories Data Queries (FIDQ) search indicated that Rockface Creek (Watershed code: 310-808200-42500-20500) has not been documented to contain fish nor its tributary located north of the creek (CITE). The Sensitive Habitat Inventory Mapping (SHIM) conducted for the creek describes it as a natural, ephemeral creek with cascade/pool (segment 6) and riffle/pool (segment 8) morphology through the subject properties. While fish sampling has not occurred, the ephemeral nature of the stream, with likely downstream barriers to passage strongly suggest fish are not present. Substrates in segment 6 were comprised of 5% organic, 30% fines, 30% gravel, and 35% cobble with a medium level of compaction. The associated riparian habitat was described as a mature, natural coniferous forest with heavy cover and large woody debris. Substrates in segment 8 included 50% fines, 40% gravel, and 10% cobble with a low level of compaction. The associated riparian habitat was described as a mature, natural broadleaf forest with heavy cover with overhanging vegetation and abundant large woody debris.

The tributary of Rockface Creek is an ephemeral creek that is likely a remnant of historic land uses (i.e., reservoir above). Although the creek does not contain a well-defined channel in upstream areas below the RDCO park land situated between the two subject properties, springs and groundwater are close to the surface and result in a poorly defined channel in lower areas. Given this, Ecoscape considered this area to be riparian gully with a highly intermittent flow pattern (i.e., very ephemeral stream). The SHIM describes the creek as natural, non-channelized spring-fed gully with riffle/pool morphology. Substrates consist of 80% organic, 10% fines, 5% cobble and 5% boulder with a low level of compaction. The associated riparian habitat was described as a mature, natural mixed forest. In addition, a remnant catch basin was observed that appears to still be capturing some upslope flow but appeared to still be conveyed via a poorly defined channel downstream west towards Trickle Creek Road.

Dimensions of the proposed span arch culverts have been included within **Appendix B** and show that the culvert will span over both banks (i.e., top of bank) of the creek at a width of 3.35 m. As mentioned, the twin 600 mm twin culverts will be reused to replace the existing 400 mm diameter culvert at the southern tributary to Rockface Creek.

As there have been no documented observations of fish within Rockface Creek or its adjoining tributary, there is no associated least risk timing window. The potential impacts that may arise during construction works and relevant mitigation measures are summarized below.

3.1 Species at Risk

The online British Columbia Conservation Data Centre (CDC, 2022) was accessed on 2022-02-09 and reviewed for at-risk ecological communities, plants and wildlife that occur within a 1 km radius of the subject properties. The query results included Species and Ecosystems at Risk, Critical Habitat for Federally-listed Species, and Wildlife Species Inventories (WSI) of provincially Red- and Blue-listed species. Search results for at-risk ecological communities are included in Table 1, species at risk occurrences are provided in Table 2, and critical habitat occurrences are provided in Table 3.

TABLE 1. CDC listed at-risk ecological community occurrences within 1 km of the subject properties (CDC, 2022).

Common Name	Scientific Name	BC List[1]	Occurrence ID	Distance
Baltic Rush – Common Silverweed	*Juncus balticus – Potentilla anserina*	Red	11327	Approximately 500 m southwest of the subject properties.
Black Cottonwood – Douglas-fir / Douglas Maple – Common Snowberry	*Populus trichocarpa – Pseudotsuga menziesii / Acer glabrum – Symphoricarpos albus*	Red	10421 and 10420	Approximately 470 m northeast and 680 m northwest of the subject properties
Hard-stemmed Bulrush, Depp Marsh	*Schoenoplectus acutus*, Deep Marsh	Blue	12519	Approximately 500 m southwest of the subject properties.
Trembling Aspen / Common Snowberry / Kentucky Bluegrass	*Populus tremuloides / Symphoricarpos albus / Poa pratensis*	Red	10993	Partially overlays the subject properties.

[1] **Yellow**: Not considered at risk. **Blue**: Of special concern. **Red**: Endangered or threatened. **Various**: May be one of multiple potential listings, depending upon more detailed taxonomic classification.

TABLE 2. CDC listed at-risk species occurrences within 1 km of the subject properties (CDC, 2022).

Common Name	Species	SARA Schedule 1	Object ID	Distance	Critical Habitat
American Badger	*Taxidea taxus*	Endangered	11126651	Approximately 890 m west of the subject property.	Non-forested grassland and shrubland ecosystems, however their range is between 16 to 64 km2 and can therefore migrate through a range of habitats [1]
Northern Rubber Boa	*Charina bottae*	Special Concern	40107483 and 40107307	Approximately 460 m north and 130 m south of the subject properties.	Rock outcrops, rock piles, rock bluffs, or talus slopes. In the forest, the snakes are frequently found in openings under or near rocks and woody debris. In dry lowland areas, they may inhabit shrubby, treeless areas.[2]

[1]**Species at risk occurrences** were determined using the BC CDC imap tool: http://maps.gov.bc.ca/ess/hm/cdc/ on 2022-02-09.

TABLE 3. Critical habitat occurrences within 1 km of the subject properties (CDC, 2022).

Common Name	Species	SARA Schedule 1	Critical Habitat ID	Critical Habitat Status	Distance	Critical Habitat
Lewis's Woodpecker	*Melanerpes lewis*	Threatened	5852	Final	Overlays the subject properties.	Open forest or grassland with scattered trees, riparian forests adjacent to open areas and burns. Large diameter trees for perching and nesting and a diverse understory[1]

[1]**Critical Habitat Areas** were determined using the BC CDC imap tool: http://maps.gov.bc.ca/ess/hm/cdc/ on 2022-02-09.

Note: Species status was determined using the BC Species and Ecosystems Explorer tool: https://a100.gov.bc.ca/pub/eswp/ on 2022-02-09.

4.0 IMPACT ASSESSMENT

As the proposed arch culvert design is intended to span over the width of the watercourse, direct disturbance to the stream bed itself should be minimal. Thus, it is anticipated that the largest

impact from the proposed work will be the removal of the existing culverts and removal of some vegetation along the riparian areas of the stream in order to facilitate the installation. Due to the ephemeral nature of the Rockface Creek tributary and general lack of flow, impact during the culvert installation is expected to be minimal. Locations of the proposed culvert and replacement culverts can be seen in Figure 1. Ecoscape anticipates that, provided mitigation measures are adhered to, impacts on terrestrial and aquatic resource values as a result of construction will be relatively low. However, without appropriate mitigation measures, proposed works could result in the following impacts:

- Potential for the release of deleterious substances (e.g., fuel, oil, hydraulic fluid) to the (particularly riparian or aquatic) environment during the proposed works or as a result of improper storage, equipment re-fueling, and/or poorly maintained equipment.
- Potential to directly or indirectly impact wildlife and wildlife habitat during potential minor earthworks and tree clearing, including disruption of migration, breeding, or other behavior as a result of noise, impacts to air quality, and alterations to existing wildlife habitat and cover.
- Potential for the release of sediment due to improper containment measures or lack of attention to detail during the placement of materials using heavy equipment.
- There is potential for the loss of native riparian, aquatic and terrestrial vegetation during construction if disturbance limits are not clearly identified prior to and during construction.
- Potential to introduce or facilitate the spread of invasive and noxious plant species resulting from ground disturbance and seed dispersal.
- Disturbance beyond the proposed footprint if not clearly marked or identified before and during construction.

Best Management Practices for in-stream works and work occurring adjacent to water will need to be adhered to throughout construction to alleviate the risk associated with the proposed works. The most relevant BMPs that should be adhered to during the proposed work include:

- Standards and Best Management Practices for Instream Works (BC MOE 2004)
- Develop with Care Environmental Guidelines for Urban and Rural Land Development (BC MOE 2014)
- Guidelines for Amphibian and Reptile Conservation during Urban and Rural Land Development in British Columbia (2014)
- Best Management Practices for Amphibian and Reptile salvages in British Columbia (2016)
- Approved Water Quality Guidelines for Turbidity (MFLNRORD)

The following sections identify mitigation measures for the proposed works that must be adhered to.

5.0 MITIGATION MEASURES

5.1 General Recommendations for Construction

- No work or machinery can occur below the high-water mark of Rockface Creek or its tributary without having a Provincial *Water Sustainability Act* Section 11 application submitted, approved and in the possession of the contractor prior to any instream work.
- The operation or parking of equipment below the driplines of the trees must be avoided.
- The release of fine sediments, construction debris or other substances deleterious to the environment or aquatic habitat must be prevented at all times.
- All terms and conditions in any permits (i.e., Section 11) approved for this project must be followed by the contractor over the length of construction;
- Ensure that onsite machinery is in good operating condition, clean and free of leaks, excess oil or grease. Any equipment that will be used for this work will only use environmentally friendly hydraulic fluid;
- Spill trays should be kept on site and utilized beneath equipment that is not in use. Spill kits must also be kept at site and be readily available.
- Hunting, harassing, feeding, trapping, baiting or luring of any wildlife will not be conducted at any time.
- Interactions or encounters with large mammals (deer, elk, moose, bear etc.) should be reported to the Environmental Monitor (EM) immediately. If a large mammal enters the work area, work is to be stopped to allow the animal to vacate the area on its own.
- Wherever possible, trees with high wildlife value, such as veteran trees and large snags, must be conserved. Hazardous trees with wildlife value within the vicinity of the construction works should be assessed by a certified wildlife/danger trees assessor to determine levels of risk.
- No equipment refueling or servicing is to be undertaken within 30 m of the Rockface Creek, its tributary or any connecting drainages.

5.2 Nesting Bird Work Window

Avian nesting timing windows should be considered to protect nesting birds within and adjacent to the proposed work area. The following methods should be implemented in relation to nesting bird work windows.

- Section 6 of the Federal *Migratory Birds Convention Regulation* protects both the nests and eggs of migratory birds. The project area falls within the **Canadian Avian Nesting Zone A1** (MECCS 2020). The general avian nesting period for migratory birds within this zone is **March 26th to August 9th**. Section 34 of the Provincial *Wildlife Act* protects all birds and their eggs, and Section 34(c) protects their nests while they are occupied by a bird or egg. The project area falls within the Northern Okanagan Basin ecodistrict. The avian nesting period for all birds within this ecodistrict is **February 1st to September 14th** (Birds Canada 2020).
- If vegetation clearing activities are required during the identified avian nesting period, pre-clearing nesting surveys is required by an Environmental Monitor (EM) to identify active nests.
- If active nests are found within the clearing limits, a buffer will be established around the nest until such time that the EM can determine that nest has become inactive. The size of the buffer will depend on the species and nature of the surrounding habitat. Buffer sizes will generally follow provincial BMP guidelines or other accepted protocol (e.g., Environment Canada). In general, **a minimum 30 m buffer** will be established around songbird nests or other non-sensitive (i.e., not at risk) species.
- Clearing and other construction activities must be conducted within **72 hours** following the completion of the pre-clearing nesting surveys. If works are not conducted in that time, the nesting surveys are considered to have expired, and a follow-up survey will be completed to ensure that no new nests have been constructed.
- Best management practices relating to raptors and their nests can be found in Guidelines for Raptor Conservation during Urban and Rural Land Development in BC (2013).

5.3 Installation/Removal of Culverts

Ecoscape understands that the proposed works will involve the installation of arch span culverts in 3 locations over the width of Rockface Creek. A twin 600 mm CSP culvert will be removed from its original location to replace the current 400 mm culvert in place across the Rockface Creek tributary. The possible impacts from the proposed works are expected to be relatively low if mitigations and recommendations are followed accordingly. The following are specific recommendations for isolation of the work area for each culvert, which must take place prior to initiating construction:

- Silt fence must be placed along the banks of the creek prior to installation to ensure no sediment infiltration will occur during the construction period.
- Native vegetation should be retained wherever possible during culvert removal/install.

- Instream works must only begin once a Section 11 Notification has been obtained and mitigation measures are in place to isolate the area from sediment infiltration from the proposed works area and the creek.
- QEP should be on site for the initiation of work to complete an initial site review of the area. If herptiles are observed, further salvage may be advised under direction of the QEP.

5.4 Worksite Isolation

- Isolation of the work area from the wetted level of the watercourses must occur, if required for the installation/replacement of the road culverts. The use of a heavy felt geotextile fabric, lake curtain, coffer dams or similar is recommended in combination with anchoring of the fencing/curtain to ensure sediment movement beneath the fence does not occur. Fencing must be staked and secured tightly against the shore.
- The anchor/weight that holds the curtain to the bottom of the stream bed be of sufficient weight that it will not lift off the bottom during construction activities or storm/wave events. Both anchors for the curtain and stakes/pins to the substrate must be used to ensure that the curtain does not lift off the bottom.
- Regular inspections and maintenance of all erosion and sediment control measures will be required. The contractor must have all the necessary materials readily available to complete maintenance activities, including additional curtain materials, anchors, stakes, etc. If significant repairs are required, works may need to be delayed until the curtain can be repaired.

5.4.1 Turbid Water Management

If water is encountered during excavations, dewatering may be required. Options for turbid water management include the following:

- Discharging water in small quantities to well-vegetated areas of the site to allow for infiltration and reduction of runoff potential.
- Discharging water to a sump that could be established away from the watercourses within the subject properties.
- Discharging to local stormwater will only be an option if prior approval is gained from the RDCO.
- Discharge to the watercourses may be an option provided that water discharged is within the allowable limits for turbidity under the ambient water quality guidelines for turbidity, suspended and benthic sediments; see below (BC MoE, 2019). Any water discharged to the watercourses must be approved by the EM prior to discharge and the EM would need to be onsite full time.

Turbidity levels under the Ministry of Environment guidelines for fish and aquatic habitats (BC MoE, 2019) are as follows:

- During clear flow periods, induced turbidity should not exceed 8 NTU above background levels at any given time and no more than an average of 2 NTU above background levels over a 30 day period.
- During turbid flow periods, induced turbidity should not exceed background levels by more than 5 NTU at any time when background turbidity is between 8 and 50 NTU. When background exceeds 50 NTU, turbidity should not be increased by more than 10% of the measured background level at any one time.

5.4.2 Water Quality

If the isolated worksite becomes inundated with water at the time of construction, the silt curtain must remain in place until sediments within the containment area have settled and turbidity levels are within allowable limits; this needs to be approved by the EM prior to removal. Works must be conducted in accordance with the *Water Sustainability Act*. If there are unforeseen circumstances, and there are problems with turbid water, then the following recommendations apply:

- Water quality sampling will be conducted in situ with a portable HACH 2100P Turbidimeter (or equivalent) to measure ambient Nephelometric Turbidity Units (NTU) and/or a Hanna HI98129 portable pH meter (or equivalent). If sampling of total suspended solids (TSS) is deemed necessary, samples will be collected in 1 litre bottles and analyzed ex situ at a reputable laboratory (e.g., CARO). Other alternative, calibrated meters or laboratories may also be used.
- Turbidity levels will be monitored as required and must conform with the following allowable turbidity levels under the Ministry of Environment guidelines for fish and aquatic habitats (BC MoE, 2019):
    - During clear flow periods, induced turbidity should not exceed 8 NTU above background levels at any given time and no more than an average of 2 NTU above background levels over a 30-day period.
    - During turbid flow periods, induced turbidity should not exceed background levels by more than 5 NTU at any time when background turbidity is between 8 and 50 NTU. When background exceeds 50 NTU, turbidity should not be increased by more than 10% of the measured background level at any one time.
- pH levels will also be monitored as required. Levels must conform to BC MOE guidelines:
    - Emergency measures must be implemented if downstream pH has changed more than 1.0 pH unit, measured to an accuracy of +/- 0.2 pH units from the background level, or is recorded to be below 6.0 or above 9.0 pH units.

- CO_2 diffusing system must be readily available on site during any wet concrete/grouting work. Should a breach in containment occur, the CO_2 will be dissolved in water to neutralize any spikes in pH that may potentially be caused by concrete leachate. The EM will monitor pH levels and utilize this equipment as necessary.

5.4.3 Fish Salvage

A fish salvage is not anticipated for this project. However, immediately following isolation, a sweep for fish should occur to confirm and fish salvaged if observed. If fish are observed, and the isolated worksite becomes inundated with water, a salvage of the isolated area for fish will need to be conducted prior to initiating works.

- A Scientific Fish Collection Permit with the Permitting and Authorization Bureau of the Ministry of Environment must be obtained prior to any fish salvage procedure and a copy of the permit must remain onsite during salvage activities.
- Fish salvage activities will be conducted by the EM using active techniques such as beach seines, pole seines and electrofishing.
- All salvaged fish are to be released back into the applicable watercourse in similar habitat away from the work area.
- If damage occurs to the isolation area and the potential exists that fish have been able to re-enter the area, subsequent fish salvages should be completed by the EM as necessary.

5.5 Stormwater Management and Stream Protection

- No untreated stormwater should be discharged to any natural streams, ponds, wetlands, or riparian habitats contributing to them. Any formalized discharges to a waterbody require a Section 11 under the *Water Sustainability Act*.
- Stormwater management plans for the development must aim at maintaining existing drainage patterns, rates and flows without directly introducing runoff into aquatic environments. Run-off flows must be re-directed away from natural receiving basins because this can impact wetlands and moisture receiving ecosystems and should incorporate guidelines from Chilibeck (1992) and the BC Stormwater Planning Guidebook. In particular, BMP practices typically emphasize the use of in-ground stormwater disposal methods to direct stormwater runoff into underlying soils.

5.6 Clearing and Grubbing

Clearing, stripping, and grubbing limits must be clearly marked in the field prior to construction and minimized wherever possible. Unnecessary impacts to native vegetation and soils must be avoided at all times. Native vegetation, including trees, shrubs, and groundcover, should be

retained to mitigate the establishment of invasive plants and to maintain the existing ecological value sustained within the subject properties.

- Disturbance beyond the identified proposed works area must not occur without further assessment.
- Native vegetation, including trees, shrubs, and groundcover, must be retained as much as possible to mitigate the establishment of invasive plants and to maintain the existing ecological value within the subject properties.
- Flagging or snow fencing must be used to clearly delineate the construction disturbance limits prior to the commencement of works and must remain in place for the duration of works. Flagging or snow fencing will also be used to clearly identify setbacks and buffers associated with other identified environmentally sensitive areas (e.g., wildlife trees, nests).
- In the event that land and/or natural vegetation is disturbed or damaged beyond the development footprint area, **these areas must be restored and/or replanted with plant material indigenous to the area under the direction of the EM.**
- Whenever possible, equipment/machinery used must not be operated or stored within the drip line of trees and equipment must not come into contact with trees outside of the marked limits of disturbance, which could result in physical damage to the bark or limbs.
- Exposed soils must be seeded immediately following any activities that result in disturbance to native vegetation and soils. Grass seed mixes must be comprised of native species, appropriate for the environmental conditions and certified as Canada #1 Grade by Agriculture Canada to minimize the weed seed count. **Ecoscape can provide the client recommendations regarding local suppliers who can provide appropriate upland/riparian seed mixes based on the ecological communities within the site.**

5.7 Erosion and Sediment Control

This section addresses minimizing the potential for the introduction of deleterious substances to the watercourses, connecting drainages, and the RDCO riparian setbacks. The following recommendations must be adhered to throughout all stages of demolition and construction:

- The release of silt, sediment, sediment-laden water, raw concrete, concrete leachate, or any other deleterious substances into any drainage or areas of high environmental value (i.e., riparian habitats, watercourses, covenants) must be prevented at all times.
- Silt fence must be installed between the proposed development and the watercourses, any connecting drainages, the proposed covenant areas, and steep slopes that are denuded during construction to mitigate the risks to aquatic and terrestrial resources associated with runoff and sediment transport. ***Silt fence must be staked into the ground and trenched a minimum of 15 cm to prevent flow underneath the fence and must remain taut to prevent***

material from moving over the fence. Silt fencing should contain sufficient storage capacity to collect runoff and sediment deposition during storm events. Silt fencing will be monitored on a regular basis and any damages or areas where the integrity and function of the fencing has been compromised should be repaired or replaced promptly. Silt fence must remain in place where required until the completion of the development.

- Steep sloped areas could also be treated with a surface treatment, such as straw, coconut matting, or some other alternative. Ecoscape has observed that use of coconut matting significantly helps establishment of hydroseed.
- Ensure that onsite machinery is in good operating condition, clean, and free of leaks, excess oil or grease. No equipment refueling can take place within 30 m of the watercourses.
- Erosion and sediment control (ESC) should incorporate the measures described below to mitigate risks during construction works. The plan is generally based upon provincial BMPs and other specifications and includes the following principles:
    - Construction works should be conducted during periods of warm, dry weather with no forecasted precipitation.
    - Construction works should be scheduled to reduce the overall amount of time soils are exposed.
    - Natural drainage patterns should be maintained where possible.
    - Existing native vegetation should be retained where possible.
    - Stormwater and sediment-laden runoff should be directed away from exposed soils within the construction area.
- Exposed soils along slopes should be stabilized and covered where appropriate using geotextile fabric, polyethylene sheeting, tarps, or other suitable materials to reduce the potential for erosion resulting from rainfall, seepage, or other unexpected causes.
- Adjacent roadways should be kept clean and free of fine materials. Sediment accumulation upon the road surfaces must be removed and disposed of appropriately.

5.8 Emergency Spill/Response

Spills of deleterious substances can be prevented through awareness of the potential for negative impacts and with responsible housekeeping practices onsite. Maintenance of a clean site and the proper use, storage, and disposal of deleterious liquids and their containers are important to mitigate the potentially harmful effects of spills and/or leaks. The following BMPs are adapted from Chilibeck et al. (1992) to provide guidance in the control of deleterious substances.

- The contractor will ensure that all equipment is inspected daily for fluid/fuel leaks and maintained in good working order.
- **No equipment refueling or servicing is to be undertaken within 30 m of Rockface Creek or its adjoining tributary.**
- All spill events will be recorded and reported to the site supervisor and EM. In the event of a spill, the site supervisor will be immediately notified by workers onsite. The supervisor will then be responsible for contacting a mechanic (if necessary), the project manager and the EM.
- Spills occurring on dry land will be contained, scraped and disposed of appropriately. Contaminated material will be stored on tarps and covered to prevent mobilization and will be disposed of in accordance with the *Environmental Management Act*.
- Spills shall be contained, absorbed, and disposed of in accordance with the regulations outlined in the *Environmental Management Act* and using the following general steps:
    - Assess, monitor and prevent the hazard or threat.
    - Stabilize, contain, remove and clean up the hazard or threat.
    - Evacuate persons.
    - Recover and rehabilitate wildlife.
    - Restore wildlife habitat.
    - Take other steps to address the long-term impacts resulting from the spill.
- Copies of contact phone numbers for notification of all of the required authorities in the event of a spill/emergency response should be posted and clearly visible at the site.
- Spill containment kits must be kept readily available onsite during construction in case of the accidental release of a deleterious substance to the environment. Any spills of a toxic substance should be immediately reported to the **Emergency Management BC 24-hour hotline at 1-800-663-3456.**

5.9 Invasive Species Management

- Ongoing invasive species control will be required within any areas with exposed/disturbed soils. Species that are aggressive have the potential to outcompete native species.
- The contractor will ensure that all equipment and vehicles are washed and free of weed seeds prior to mobilization and de-mobilization. Vehicles and equipment should not be stored, parked, or staged within weed infested areas if possible. Contractor clothing should also be inspected daily for signs of weed seeds. If found, weed seeds should be disposed of in a contained refuse bin for offsite disposal.

- Care must be taken to ensure that invasive species removal does not impact existing native tree and shrub species.
- Invasive plant species must be disposed of in a landfill; however, invasive species material must not be composted in the yard waste section of the landfill. Invasive plant species must not be transported to or deposited in other natural areas.

5.10 Site Cleanup

- Site cleanup and restoration refers to activities used to return disturbed areas within the subject property to a state resembling the original habitat characteristics. Note that protection of existing ecosystems is generally much more efficient than ecosystem enhancement and restoration following construction. The following recommendations apply to the site cleanup efforts:

- Silt fencing, snow fence and other temporary mitigation features must be removed upon substantial completion of works when the risk of surface erosion and sediment transport has been adequately mitigated with other permanent measures.
- All equipment, supplies, waste, concrete, and other non-biodegradable materials must be removed from the site following the substantial completion of the proposed work.
- Impacts from invasive species include the displacement or competitive exclusion of native species. Prevention of the establishment of invasive species can be achieved by limiting disturbance to soils and native vegetation where possible.
- **Ecoscape understands that currently no major restoration planting has been proposed for the project besides general hydroseeding – if needed.** Should further restoration be required, plant species selected should be native to the area and suitable to the growing conditions where the plantings have been proposed.

6.0 ENVIRONMENTAL MONITORING

To ensure compliance with BMPs and minimize risks to terrestrial ecosystems, an EM should be retained during construction activities. The EM will document compliance with BMPs, terms of the Section 11 permit, mitigation measures, and other recommendations and provide guidance for implementation of operational best practices (e.g., erosion and sediment control). In the event that greater disturbance occurs due to unforeseen circumstances, the EM will recommend further measures to protect/restore the natural integrity of the site.

- A pre-construction meeting should be held between the EM and the contractor(s) undertaking the work onsite to ensure a common understanding of the mitigation measures and best practices required for the project. The EM will be able to determine an appropriate schedule for monitoring based upon the time of year construction will occur and specific risks at that time.

- The EM will be an appropriately qualified environmental professional (QEP) authorized to halt construction activities should an incident arise that is causing undue harm (unforeseen or from lack of due care) to terrestrial, aquatic or riparian resource values.
- Construction activities should be monitored full time during instream works and any high-risk activities (i.e., clearing, grubbing, instream work), and weekly during other periods when works are occurring in proximity to environmentally sensitive areas. During low-risk activities, a minimum site review on a monthly basis during low-risk construction activities is required for the project.
- Monitoring reports will be submitted to all relevant contractors and regulatory agencies. A final report will be generated upon the substantial completion of construction works summarizing the construction activities and listing any deficiencies noted throughout the works.

7.0 CONCLUSION

This report pertains to existing and potential site conditions with respect to aquatic and terrestrial habitats within the proposed works area. If the mitigation measures provided by Ecoscape for protection of aquatic and riparian resources are adhered to, potential impacts are anticipated to be relatively low.

8.0 CLOSURE

This report has been prepared for the exclusive use of the Acorn Group (the client). It has been prepared based upon information provided to Ecoscape regarding the subject properties and proposed works. Ecoscape assumes that the provided information is accurate and has been disclosed in order to prepare the above Environmental Management Plan. The client has acknowledged that in order for Ecoscape to properly provide the professional service, Ecoscape is relying upon full disclosure and accuracy of this information. This report should not be interpreted as an endorsement of the proposed works, but as a municipal tool for decision making.

If you have any questions or comments, please contact the undersigned at your convenience.

Respectfully Submitted,

ECOSCAPE Environmental Consultants Ltd.

Prepared by:

Reviewed by:

Cindy Newton, B.Sc., B.I.T

Natural Resource Biologist

Direct Line: (778.940.1678

Leanne McDonald, B.Sc., R.P.Bio., P.Ag.

Natural Resource Biologist

Direct Line: 778.940.1733

Attachments: Figures

Appendix A – General Terms and Conditions

Appendix B – Arch Culvert Design Provided By: Alpine Consultants Ltd.

Appendix C – Engineering Civil Designs and Phase 6.0 Servicing Brief Provided By: WSP and Alpine Consultants Ltd.

Appendix D – Phase 4.3 and 4.4 Servicing Briefs Provided By: Alpine Consultants Ltd.

Appendix E – Site Photos

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Figures

FIGURE 1
Site Location

Project:	Environmental Assessment
Location:	RDCO
Project No.:	21-3654
Prepared for:	Acorn Group
Prepared by:	Ecoscape Environmental Consultants Ltd. Josh Castanier, GIS Technician
Coordinate System:	NAD83-UTM Zone 11
Imagery:	RDCO 2019
Field Visit:	March 12, 2021
Map Date:	July 28, 2021

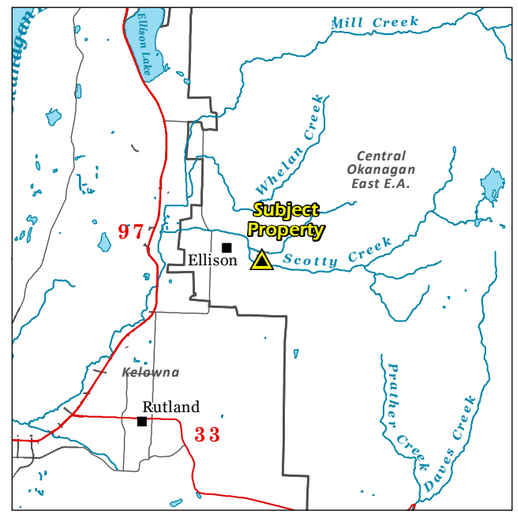
LEGEND

- Regional Location of Study Area
- Streams
- Wildlife Species Inventory (Survey)
- Wildlife Species Inventory (Incidental)
- Okanagan Critical Habitat (Species at Risk)
- BC Conservation Data Center (CDC) Polygons*
- Subject Property
- Cadastre

*A large Okanagan Critical Habitat polygon covers the entire map and subject property area representing the following wildlife species but is not shown on this figure:
- Western Rattlesnake (*Crotalus oreganus*)
- Desert Nightsnake (*Hypsiglena chlorophaea*)
- Great Basin Gophersnake (*Pituophis catenifer deserticola*)
-Lewis Woodpecker (*Melanerpes lewis*)

BC Conservation Data (CDC polygons) include:
-American Badger (*Taxidea taxus*)

Regional Location of Study Area



DISCLAIMER
The data displayed is for conceptual purposes only and should not be interpreted as a legal survey or for legal purposes. If discrepancies are found between the data portrayed in this report and that of a legal survey, the legal survey will supersede any data presented herein.

ECOSCAPE Environmental Consultants Ltd.

FIGURE 2
Section 11 Proposed Works

Project:	Environmental Assessment
Location:	RDCO
Project No.:	21-3654
Prepared for:	Acorn Group
Prepared by:	Ecoscape Environmental Consultants Ltd. Dan Austin, GIS Specialist
Coordinate System:	NAD83-UTM Zone 11
Imagery:	RDCO 2019
Field Visit:	March 12, 2021
Map Date:	March 2, 2022

LEGEND

- Proposed Works
- Subject Property

Proposed Works:
1) Upgrade to Arch Culvert
2) Connect Stormwater Discharge

Proposed Works:
Upgrade to Arch Culvert

Proposed Works:
1) New Crossing with Arch Culvert
2) Connect Stormwater Discharge

Proposed Works:
1) Connect Stormwater Discharge

Proposed Works:
1) Replace with 2x 600mm Culvert
2) Connect Stormwater Discharge

Subject Property

TRICKLE CREEK DR
CAMELBACK DR
PINE VALLEY DR
SUNSET RANCH DR
SEMINOLE RD
SEMINOLE RISE
ROCKFACE CREEK
SCOTTY CREEK

N

0 10 20 40 60 80
Meters

331600 331640 331680 331720 331760 331800 331840 331880 331920 331960 332000 332040 332080 332120

5534160 5534120 5534080 5534040 5534000 5533960 5533920 5533880 5533840 5533800 5533760

ECOSCAPE
Environmental Consultants Ltd

Appendix A

General Terms and Conditions

ECOSCAPE ENVIRONMENTAL CONSULTANTS LTD.

#102 – 450 Neave Ct., Kelowna, BC. V1V 2M2

Tel: 250. 491.7337 Fax: 250. 491.7772

www.ecoscapeltd.com

Terms and Conditions

General

This agreement shall be binding on the Client and Ecoscape Environmental Consultants Ltd. (Ecoscape) unless the Client provides written notice to Ecoscape within five (5) business days from the date of issuance it rejects any part of this agreement. Ecoscape, may at its sole discretion and at any stage engage sub consultants to perform all or any part of the Services.

Scope of Work

The scope of work for services has been agreed upon in the proposal and within the Letter of Agency.

Compensation and Payment Terms

Charges for the Services rendered will be made in accordance with Ecoscape's' Schedule of Fees and Disbursements in effect from time to time as the Services are rendered. All Charges will be payable in Canadian Dollars. Invoices will be due and payable by the Client within thirty (30) days of the date of the invoice without hold back. Interest on overdue accounts is 12% per annum.

Termination

Either party may terminate this engagement without cause upon thirty (30) days' notice in writing. On termination by either party under this paragraph, the Client shall forthwith pay Ecoscape its Charges for the Services performed, including all expenses and other charges incurred by Ecoscape for this Project. If either party breaches this engagement, the non-defaulting party may terminate this engagement after giving seven (7) days' notice to remedy the breach. On termination by Ecoscape under this paragraph, the Client shall forthwith pay to Ecoscape its Charges for the Services performed to the date of termination, including all fees and charges for this Project. On termination by either party, Ecoscape will cancel any application processes that have been initiated with relevant agencies regardless of the status of the application. Reliance on any reports, files, or other information provided by Ecoscape to the client or relevant agencies (Municipal, First Nations, Provincial, or Federal), either under separate Contract or under the terms of our Agency representing the client, cannot be transferred to any other party, including relevant Provincial Agencies, without our express written agreement.

Professional Standards

In the performance of professional services, Ecoscape will use the degree of care and skill ordinarily exercised, conforming to recognized standards, and upholding professional ethics founded upon integrity, competence, and a responsibility to provide sound management and conservation of biological resources and legislated requirements at all levels of government. Ecoscape reserves the right to report occurrences of rare and endangered species resulting from inventories and incidental observations to the Conservation Data Centre or relevant Municipal, Provincial, or Federal authority. The client shall be responsible for presenting any and all information necessary for Ecoscape to undertake and adhere to professional standards. Ecoscape is not responsible and will bear no liability, whatsoever, for failure to provide or disclose any information, relevant to an application process, the subject property, Client, or otherwise. Further, Ecoscape reserves the right to determine whether information is relevant, and through signature on this agreement, the Client agrees that all relevant information pertaining to the Client, Property, Application Process, or otherwise has been disclosed and provided to Ecoscape in writing. The Client acknowledges that Ecoscape may be required by law to disclose information to regulatory agencies and hereby consents to such disclosure of information provided to relevant regulatory agencies, unless agreed to in writing.

Environmental, Site Information and Disclosure

The client agrees to fully cooperate with Ecoscape with respect to the provision of all available information on the past, present, and proposed conditions of the site. The Client acknowledges that in order for Ecoscape to properly provide the professional service, Ecoscape is relying upon full disclosure and accuracy of this information. The Client acknowledges that Ecoscape will be required to provide any information requested to relevant agencies as required, and the Client must notify Ecoscape in writing of any information that is considered confidential. Ecoscape will not be responsible or liable for providing requested information to a relevant Municipal, Provincial, or Federal authority that the Client fails to notify Ecoscape in writing is confidential or for the viewing of Ecoscape only. Ecoscape's field investigations and recommendations will not address or evaluate pollution of aquatic resources, water, soil or groundwater unless we are specifically retained to provide such services. Ecoscape will co-operate with the Client's consultant(s) and any relevant regulatory Agencies, whether Municipal, Provincial, during the investigations as required, but reserves the right to amend scope to include such services if required.

ECOSCAPE ENVIRONMENTAL CONSULTANTS LTD.

#102 – 450 Neave Ct., Kelowna, BC. V1V 2M2

Tel: 250. 491.7337 Fax: 250. 491.7772

www.ecoscapeltd.com

Limitation of Liability

Ecoscape shall not be responsible or liable for:

1. the failure of a contractor, retained by the Client, to perform the work required in the Project in accordance with the applicable contract documents or recommendations made in reports or in the field by Ecoscape;
2. the design of or defects in equipment supplied or provided by the Client for incorporation into the Project including any relevant construction drawings or designs, or information provided by any other third party such as a designer or consultant;
3. any Project decisions made by the Client without the advice of Ecoscape or contrary to or inconsistent with Ecoscape's advice;
4. any consequential loss, injury or damages suffered by the Client, including but not limited to loss of use, earnings and business interruption;
5. the unauthorized distribution of any confidential document or report prepared by or on behalf of Ecoscape for the exclusive use of the Client.

The total amount of all claims the Client may have against Ecoscape under this engagement, including but not limited to claims for negligence, negligent misrepresentation and breach of contract, shall be strictly limited to $5,000.00. Only if specifically agreed to in writing by Ecoscape would this be revised to a specific amount of professional liability insurance Ecoscape may have available at the time such claims are made. In the event that Ecoscape is not carrying professional liability insurance at the time of a claim, the total amount payable would be $0 under either circumstance.

No claim may be brought against Ecoscape in contract or tort more than two (2) years after the Services were completed or terminated under this engagement.

Personal Liability

For the purposes of the limitation of liability provisions contained in the Agreement of the parties herein, the Client expressly agrees that it has entered into this Agreement with Ecoscape, both on its own behalf and or acting as an agent on behalf of another party, its employees and/or principals. The Client expressly agrees that Ecoscape's employees and principals shall have no personal liability to the Client in respect of a claim, whether in contract, tort and/or any other cause of action in law. Accordingly, the Client expressly agrees that it will bring no proceedings and take no action in any court of law against any of Ecoscape's employees or principals in their personal capacity.

Third Party Liability

Any reports or information provided by Ecoscape as an agent was prepared by Ecoscape for the account of the Client. The material in it reflects the judgment and opinion of Ecoscape in light of the information available or provided to Ecoscape at the time of preparation. Any use of reports or information provided by Ecoscape to the Client cannot be provided to another party without our expressed, written permission. Any use or reliance upon reports or information provided Ecoscape, for which reliance has not been provided by Ecoscape, is the responsibility of the third party using or relying upon that information and Ecoscape cannot be held responsible or liable for any decisions to be made based on it. Ecoscape accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report or information provided to regulatory authorities in carrying out these services. This report may not be used or relied upon by any other person unless that person is specifically named by us as a beneficiary of the Report. The Client agrees to maintain the confidentiality of the Report and reasonably protect the report from distribution to any other person.

Documents

All of the documents or information prepared by Ecoscape or on behalf of Ecoscape in connection with the Project are instruments of service for the execution of the Project. Ecoscape retains the property and copyright in these documents, whether the Project is executed or not. These documents may not be used on any other project without the expressed prior written agreement of Ecoscape.

Field Services

Where applicable, field services recommended for the Project are the minimum necessary, in the sole discretion of Ecoscape, to carry out in general conformity with the intent of the Services. Field investigations may identify additional field requirements that are required to be undertaken prior to completion of this agreement. Ecoscape will not proceed with additional field works

without the express written consent of the Client. If Ecoscape recommends additional field visits and the Client advises these works are not to be undertaken, Ecoscape will be required to prepare written documentation addressing field data collection limitations.

Dispute Resolution

If requested in writing by either the Client or Ecoscape, the Client and Ecoscape shall attempt to resolve any dispute between them arising out of or in connection with this Agreement by entering into structured non-binding negotiations with the assistance of a mediator on a without prejudice basis. The mediator shall be appointed through agreement by all parties. If a dispute cannot be settled within a period of thirty (30) calendar days with the mediator, the dispute shall be referred to and finally resolved by an arbitrator appointed by agreement of all of the parties.

Agreement

This agreement is binding and will ensure to the benefit of the Client and Ecoscape. These conditions form a part of the proposal, with the same effect as if set forth therein. Verbal and email approvals to proceed with work outlined above are subject to the same conditions as this contract.

Appendix B

Arch Culvert Design Provided By: Alpine Consultants Ltd.

February 6, 2022

ALPINE
Consultants Ltd.

Sunset Two Properties
3744 Seminole Road
Kelowna BC V1W 4B4

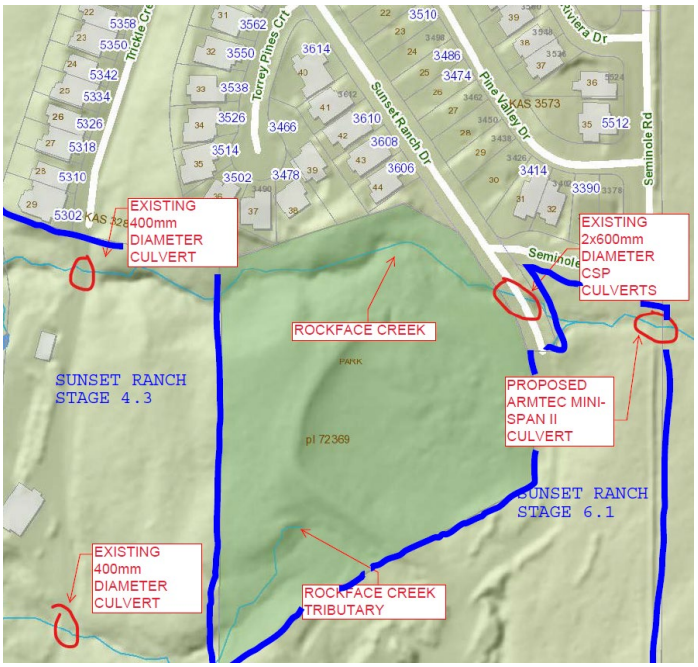
Alpine Project No: 2021-085
Alpine Permit to Practice:1000176

Attention: **Mr. Greg Bird**
President

Re: **Culvert Design Brief**
Sunset Ranch Stages 4 & 6
Proposed Residential Subdivision

Alpine Consultants Ltd. is pleased to provide this Culvert Design Brief in support of the proposed residential subdivisions of Sunset Ranch Stages 4 & 6. The proposed development seeks one new culvert crossing of Rockface Creek and three culvert upgrades of existing infrastructure.

The new crossing, to serve Stage 6 at the eastern boundary at the southerly extension of Seminole Road, is proposed to be an Armtec MiniSpan II 3350m span arch culvert across Rockface Creek. Downstream of this crossing, it is proposed to replace a pair of 600mm CSP Culverts at the southerly extension of Sunset Ranch Drive into Stage 6, and one 400mm-diameter culvert at the southerly extension of Trickle Creek Drive into Stage 4 with the same arch culvert.



The fourth culvert, upgrading the existing 400mm-diameter culvert across the southern tributary to Rockface Creek, is proposed to replace the existing culvert and reuse the twin 600m-CSP culverts from Sunset Ranch Drive.

The Environmental Assessment by Ecoscape Environmental Consultants Ltd, August 2021, states:

- *"Rockface Creek is a 2nd order stream approximately 4.74 km in total length and is not documented to contain fish."*
- *"The tributary of Rockface Creek is an ephemeral creek that is likely a remnant of historic land uses (i.e., reservoir above). Although the creek does not contain a well-defined channel in upstream areas below the RDCO park land situated between the two subject properties."*

In support of an Application under the Water Sustainability Act, Water Sustainability Regulation, Section 11 Request for Permit, we provide the following design information for the proposed culvert crossings:

I. The equipment that will be used will be as follows:
   a. Excavators
   b. Front End Loader
   c. Dump Trucks
   d. Compactors
   e. Graders

II. Rockface creek is not fish bearing, and the Tributary is ephemoral.

III. The design of the arch culvert will see riprap or sandbag head walls to protect for erosion at the inlet.

IV. The design of the arch culvert will see a wider area so that debris can pass through smoothly.

V. The concept for the culvert installations is to span, hence not disturb, the creek bed. This allows creek channel to remain as is. The three removals will be undertaken carefully, with environmental supervision, utilizing the recommendations below.

VI. With the arch culvert being wider than the creek, and significant increases in flow capacity, there are no foreseen conditions to produce any back water effect.

VII. The design of the arch culvert will ensure conveyance of the 1:200 storm event.

VIII. The proposed arch culverts will have a span of 3.35m. The existing culverts are 0.6 and 0.4m in diameter respectively. Re-use of only the twin 600mm culverts is proposed.

IX. The arch culvert that is being proposed for this phase is an Armtech Mini Span II. This arch culvert design will be refined by the supplier's engineer, in support of the design herein, and installed by a qualified contractor.

X. No debris obstacles are anticipated in this channel; however, obstacles encoungered throughout the construction will be removed with such care that the creek bed will not be altered. Grillage will be evaluated by the supplier and design engineer, and debris guards considered as appropriate.

XI. The creek alignment will be protected.

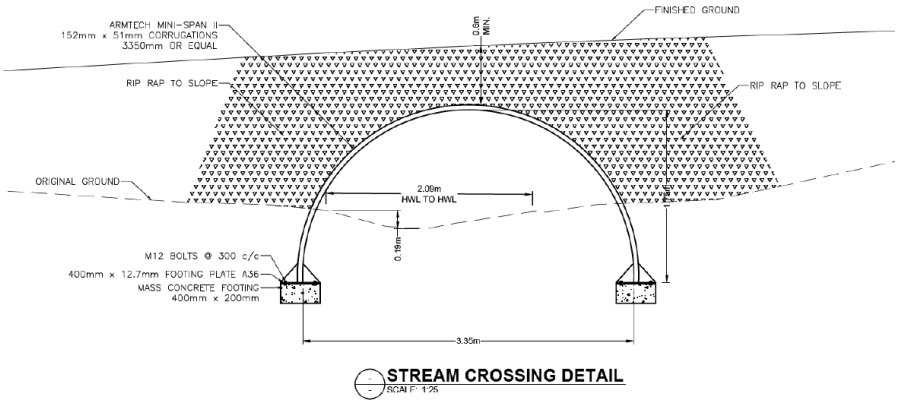
XII. The embankment headwalls will ensure protection and limit encroachment of the inlets and outlets.

XIII. The cover overtop of the arch culvert will be greater that 0.6m as shown in the diagram below.

XIV. The fill height overtop of the arch culvert will not exceed 2m.

XV. The supplier culverts meet CSA standards.

Diagram



The Ecoscape Report recommends mitigation measures including:

- *"No works can occur below the high-water mark of Rockface Creek, Rockface Creek tributary or Scotty Creek without having a Provincial Water Sustainability Act Section 11 Notification or Approval application submitted, approved and in the possession of the owner and contractor prior to works. This document must be kept on site at all times so it can be provided to Ministry representatives or officers upon request;"*
- *"Isolation of the work area from the wetted level of the watercourses must occur, if required for the installation of road culvert(s). The use of a heavy felt geotextile fabric, lake curtain, coffer dams or similar is recommended in combination with anchoring of the fencing/curtain to ensure sediment movement beneath the fence does not occur. Fencing must be staked and secured tightly against the shore;*
- *The anchor/weight that holds the curtain to the bottom of the watercourse must be of sufficient weight that it will not lift off the bottom during construction activities or storm/wave events. Both anchors for the curtain and stakes/pins to the substrate must be used to ensure that the curtain does not lift off the bottom;*
- *Disturbance to watercourse substrates must be kept to a minimum with work site isolation activities; and,*
- *Regular inspections and maintenance of all erosion and sediment control measures will be required. The contractor must have all the necessary materials readily available to complete maintenance activities, including additional curtain materials, anchors, stakes, etc. If significant repairs are required, works may need to be delayed until the curtain can be repaired."*

Alpine Consultants Ltd. will be the engineer-of-record in both the design and inspection/oversight of these culvert works. It is our intent to undertake all four in mid-2022 as approvals and permits allow. We trust this information will be sufficient to support your Application. Please feel free to contact me should you require any additional information or clarification.

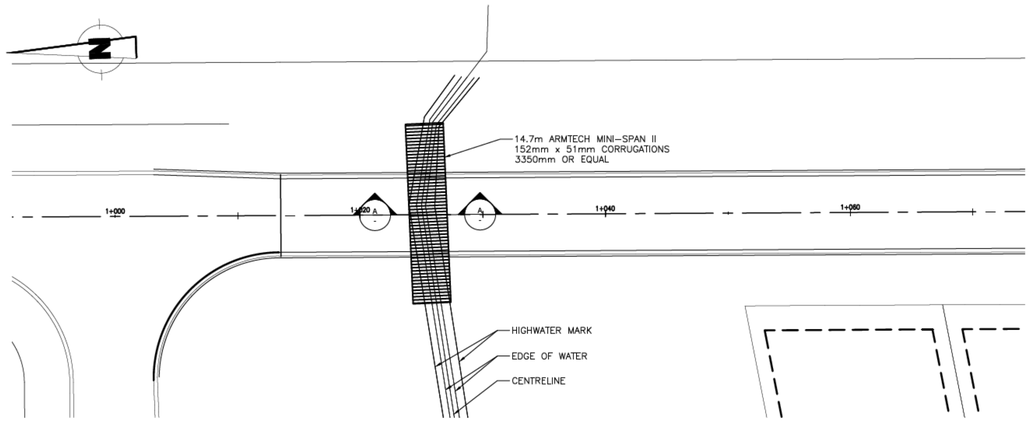
Sincerely,
ALPINE CONSULTANTS LTD.

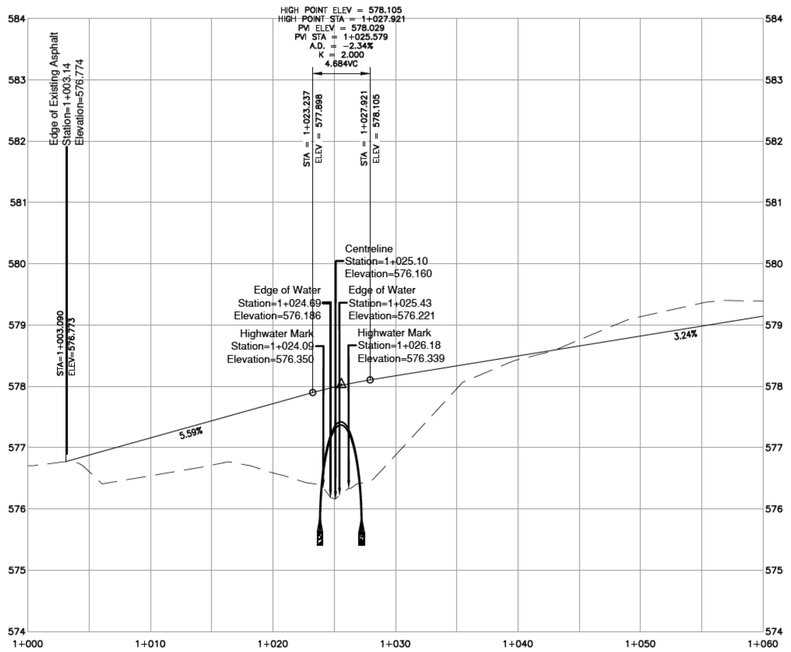
James Kay

Jason Angus
Project Coordinator/Design Technologist

James Kay, P.Eng
Principal/Project Manager

CC: Ms. Brittany Nichols, RDCO
Ms. Leanne McDonald, Ecoscape





A-A SEMINOLE ROAD STREAM CROSSING PROFILE

SCALE: H: 1:250 V: 1:50

ISSUED FOR DEVELOPMENT PERMIT 16-07-15

LEGEND

EX. SEWER PIPE	
EX. SANITARY SEWER PIPE	
EX. WATER PIPE	
PROP. STORM SEWER PIPE	
PROP. SANITARY SEWER PIPE	
PROP. WATER PIPE	
PROP. ELEVATION	XXXXX
EX. ELEVATION	XXX.XX

MANHOLE	M.H.
UTILITY POLE	U.P.
POWER POLE	P.P.
LAMP STANDARD	L.S.
CATCH BASIN	C.B.
HYDRANT	HYD
TREES	T
SURVEY MONUMENT	

NAD 83

INSERTION BASE POINT= 0 , 0

Locations and offsets of existing utilities shown on this plan are not guaranteed to be accurate and must be verified in the field PRIOR TO CONSTRUCTION. The City of Kelowna does not guarantee their accuracy. Concerned persons should not rely on these documents and should verify all information shown by way of site survey and other appropriate methods. The City of Kelowna accepts no liability for use of these files or information.

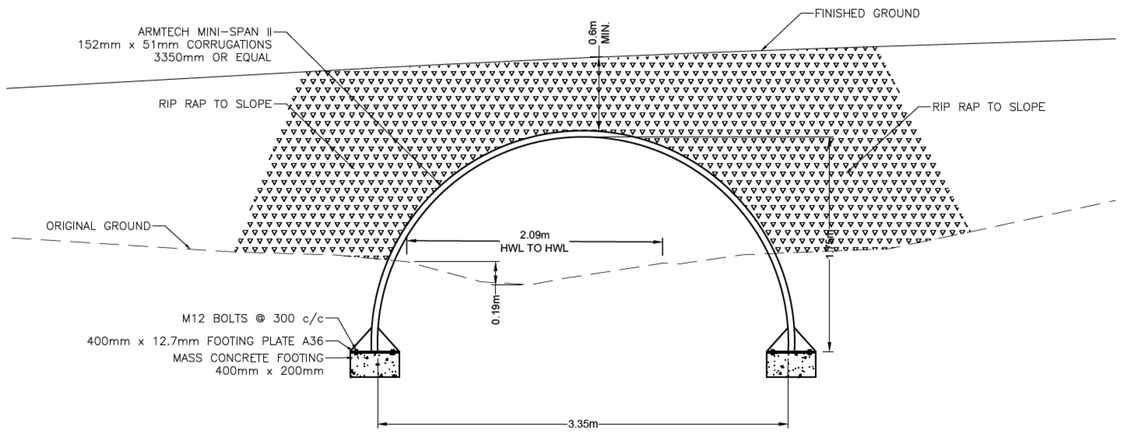
NO.	DATE	BY	REVISION	CH'KD
0	2016-07-15	NS	ISSUED FOR DEVELOPMENT PERMIT	SB

WSP
ENGINEERING · PLANNING · GEOMATICS
#602-1708 DOLPHIN AVENUE
KELOWNA BC, V1Y 9S4
PHONE (250 980-5500
FAX (250) 980-5511

BASE JRG DESIGN JRG
APPROVED SB
DATE JUNE 15 2016
SCALE
SCALE NOT ACCURATE OVER LONG DISTANCES

THE REGIONAL DISTRICT OF THE CENTRAL OKANAGAN
DESIGN AND CONSTRUCTION
ACORN RESORTS LIMITED PARTNERSHIP
SUNSET RANCH STAGE 6 – PHASE ONE
SEMINOLE ROAD CROSSING
PLAN AND PROFILE

DIVISION: MUNICIPAL
DRAWING NO.: C700
REV NO: 0



STREAM CROSSING DETAIL

SCALE: 1:25

ISSUED FOR DEVELOPMENT PERMIT 16-07-15

LEGEND

EX. SEWER PIPE
EX. SANITARY SEWER PIPE
EX. WATER PIPE
PROP. STORM SEWER PIPE
PROP. SANITARY SEWER PIPE
PROP. WATER PIPE
PROP. ELEVATION XXXXX
EX. ELEVATION XXXXX

MANHOLE M.H.
UTILITY POLE U.P.
POWER POLE P.P.
LAMP STANDARD L.S.
CATCH BASIN C.B.
HYDRANT HYD
TREES
SURVEY MONUMENT

NAD 83

INSERTION BASE POINT= 0 , 0

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NO.	DATE	BY	REVISION	CH'KD
0	2016-07-15	NS	ISSUED FOR DEVELOPMENT PERMIT	SB

WSP
ENGINEERING • PLANNING • GEOMATICS
#602-1708 DOLPHIN AVENUE
KELOWNA BC, V1Y 9S4
PHONE (250) 980-5500
FAX (250) 980-5511

BASE JRG DESIGN JRG
APPROVED SB
DATE JUNE 15 2016
SCALE
SCALE NOT ACCURATE OVER LONG DISTANCES

THE REGIONAL DISTRICT OF THE CENTRAL OKANAGAN
DESIGN AND CONSTRUCTION
ACORN RESORTS LIMITED PARTNERSHIP
SUNSET RANCH STAGE 6 – PHASE ONE
SEMINOLE ROAD CROSSING
DETAILS

DIVISION: MUNICIPAL
DRAWING NO.: C701
REV NO: 0

Appendix C

Engineering Civil Designs and Phase 6.0 Servicing Brief Provided By: WSP and Alpine Consultants Ltd.

ISSUED FOR DEVELOPMENT PERMIT 16-07-15

LEGEND
- EX. SEWER PIPE
- EX. SANITARY SEWER PIPE
- EX. WATER PIPE
- PROP. STORM SEWER PIPE
- PROP. SANITARY SEWER PIPE
- PROP. WATER PIPE
- PROP. ELEVATION (XXX.XX)
- EX. ELEVATION XXX.XX

- MANHOLE M.H.
- UTILITY POLE U.P.
- POWER POLE P.P.
- LAMP STANDARD L.S.
- CATCH BASIN C.B.
- HYDRANT HYD
- TREES T
- SURVEY MONUMENT

NAD 83

INSERTION BASE POINT= 0 , 0

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0	2016-07-15	NS	ISSUED FOR DEVELOPMENT PERMIT	SB

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ENGINEERING · PLANNING · GEOMATICS
#602-1708 DOLPHIN AVENUE
KELOWNA BC, V1Y 9S4
PHONE (250 980-5500
FAX (250) 980-5511

BASE JRG | DESIGN JRG
APPROVED SB
DATE JUNE 15 2016
SCALE
SCALE NOT ACCURATE OVER LONG DISTANCES

THE REGIONAL DISTRICT OF THE CENTRAL OKANAGAN
DESIGN AND CONSTRUCTION

ACORN RESORTS LIMITED PARTNERSHIP
SUNSET RANCH STAGE 6 – PHASE ONE

EROSION AND SEDIMENT CONTROL PLAN

DIVISION: MUNICIPAL
DRAWING NO.: C500
REV NO: 0

EROSION AND SEDIMENT CONTROL PLAN GENERAL NOTES

1. SUPPLY AND INSTALL SILT FENCE AS REQUIRED.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONSTRUCTING ALL TEMPORARY BERMS, SETTLING AREAS, INTERCEPTOR DITCHES AND CHECK DAMS TO PREVENT SILTATION AND DOWNSTREAM EROSION.
3. THE CONTRACTOR MUST MONITOR THE STATUS OF THE SITE AND THE SILT AND EROSION CONTROL MEASURES. ANY MAINTENANCE REQUIRED TO ANY OF THE SILT AND EROSION CONTROL FEATURES MUST BE CONDUCTED IMMEDIATELY.
4. THE CONTRACTOR SHALL HAVE A QUALIFIED ENVIRONMENTAL MONITOR AS PER THE SPECIFICATIONS.
5. ALL SILT AND EROSION CONTROL PROCEDURES TO BE DONE IN ACCORDANCE WITH THE "BEST MANAGEMENT PRACTICES FOR EROSION AND SEDIMENTATION CONTROL - UPLAND WORKS" BY THE CITY OF KELOWNA.
6. UNDER THIS PLAN, ALL PERSONS INCLUDING BUT NOT LIMITED TO THE DEVELOPER, OWNER OF THE LAND, THE ENGINEER OF RECORD, ESC SUPERVISOR, CIVIL CONTRACTOR, CIVIL SUB-CONTRACTOR, BUILDER & BUILDING SUB-TRADES HEREIN AFTER REFERRED TO AS THE OWNER/DEVELOPER/PERSON RESPONSIBLE; ENGAGED ON SITE SHALL COMPLY WITH ALL REGULATORY REQUIREMENTS SPECIFIED BY FEDERAL, PROVINCIAL AND MUNICIPAL AUTHORITIES; PERTAINING TO ON SITE MANAGEMENT AND DISCHARGE ASSOCIATED WITH EROSION AND SEDIMENT CONTROL REGULATIONS.
7. THE DEVELOPER/PERSONS RESPONSIBLE SHALL COMPLETE ALL CONSTRUCTION ACTIVITIES IN A MANNER THAT ACHEIVES BEST MANAGEMENT PRACTICES TO PREVENT AND CONTAIN ON-SITE, SILT LADEN RUNOFF THAT EXCEEDS 75MG/L TSS FROM ENTERING DOWNSTREAM DRAINAGE INFRASTRUCTURE AND AQUATIC SYSTEMS.
8. THE ESC SUPERVISOR IS RESPONSIBLE TO MONITOR, INSPECT AND REPORT TO THE DEVELOPER, CONTRACTOR, AND CITY ON EROSION AND SEDIMENT CONTROL FACILITIES & SITE DISCHARGE PERFORMANCE IN ACCORDANCE TO THE CITY'S SEDIMENT CONTROL PROCESS.
9. THE DEVELOPER/OWNER/PERSONS RESPONSIBLE MUST COMPLY WITH THE ESC PLAN WITHIN THE SPECIFIED TIMEFRAME, AND COMPLY WITH ALL INSTRUCTION ISSUED BY THE ESC SUPERVISOR TO RECTIFY DEFICIENCIES THAT RESULT IN NON-CONFORMANCE WITH THE PERMIT.
10. ALL SITE ACCESS FROM DISTURBED AREAS TO PAVED SURFACES IS TO BE RESTRICTED AND SHALL LIMIT THE TRANSPORT OF SEDIMENT ONTO ROADWAYS.
11. HYDROSEEDING REQUIREMENTS

11.1 HYDROSEED FINISHED DITCH SLOPES AND ALL OTHER AREAS DISTURBED BY CONSTRUCTION.

11.2 HYDROSEEDING APPLICATION RATES:

1)	NATIVE SEED BLEND	45 kg/ha
2)	ANNUAL RYE	10 kg/ha
3)	FERTILIZER (18-18-18-2)	300 kg/ha
4)	CANFOR ECOFIBRE MULCH	2,400 kg/ha
5)	TAC (GUAR 3% OF MIX)	66 kg/ha

11.3 DRYLAND GRASS MIX (% BY WEIGHT)
SEED MIX TO BE CERTIFIED #1 GRADE

1)	CRESTED WHEAT GRASS	20%
2)	FALL RYE	15%
3)	PERENNIAL RYEGRASS	15%
4)	ANNUAL RYEGRASS	10%
5)	CREEPING RED FESCUE	10%
6)	HARD FESCUE	10%
7)	SLENDER WHEAT GRASS	10%
8)	TALL WHEAT GRASS	10%

MAINTENANCE ALL STAGES (AS APPLICABLE)

- NO ON-SITE TRADE PARKING WILL BE PERMITTED.
- ALL INSPECTIONS/MONITORING TO BE CARRIED OUT BY THE ESC SUPERVISOR UP TO THE EXPIRY OF THE PERMIT.
- UPON INSTRUCTION/NOTIFICATION BY ESC SUPERVISOR; PERSONS RESPONSIBLE ARE REQUIRED TO UNDERTAKE MAINTENANCE ACTIVITIES AS DEEMED SPECIFIED TO MODIFY OR MAINTAIN ESC FACILITIES.
- ALL CATCH BASIN FILTER SOCKS ARE TO BE INSPECTED WEEKLY OR FOLLOWING STORM EVENTS, INLINE FILTERS ARE TO BE REMOVED AND CLEANED AT 33% CAPACITY.
- ACCUMULATED SEDIMENT DEPOSITION IN FILTER BERMS ARE TO BE REMOVED AT 50% CAPACITY.
- GRAVEL ACCESS PADS SHALL BE INSPECTED DAILY TO ENSURE FUNCTIONALITY, ADD ADDITIONAL ROCK AS REQUIRED.
- THE DEVELOPER OR BUILDER MUST REGULARLY CLEAN ON AND OFF SITE PAVED ROAD SURFACES OF ACCUMULATED SIDMENTS AT THE END OF EACH DAY OR AS REQUIRED. NO SOIL, SAND OR OTHER MATERIAL WITH A HIGH SEDIMENT CONTENT SHALL BE DEPOSITED OR PILED OUTSIDE OF THE PROPERTY BOUNDARIES, PARTICULARLY ON PAVED ROAD SURFACES.
- SILT FENCE SHALL BE PLACED ON SLOPE CONTOURS TO MAXIMIZE PONDING EFFICIENCY.
- INSPECT AND REPAIR FENCE AFTER EACH STORM EVENT (1:2 YEAR STORM EVENT AND/OR +40mm RAINFALL OVER 24 HOUR DURATION) AND REMOVE SEDIMENT WHEN ACCUMULATED SILT REACHES ½ FENCE HEIGHT OR 225mm MAXIMUM SUGGESTED STORAGE HEIGHT.
- ALL SEDIMENT REMOVED FROM ESC CONTROL FACILITIES TO BE DISPOSED OF IN A MANNER AS TO NOT COMPOUND OR COMPROMISE THE SEDIMENT LOADING OF OTHER CONTROL MEASURES.
- FILTER BERMS SHALL BE PROTECTED FROM VEHICLE TRAFFIC OR REPLACED AS NECESSARY FROM VEHICLE TRAFFIC.

CLEARING, ROAD STRIPPING, BUILDING EXCAVATION AND TEMPORARY ACCESS ROAD STAGE

- BASE OF EXCAVATION TO BE COVERED WITH 200mm OF 25mm CRUSH GRAVEL WHERE TRUCK TRAFFIC IS REQUIRED.
- DEVELOPER TO NOTIFY THE ESC SUPERVISOR 48 HOURS PRIOR TO CLEARING AND GRUBBING. DEVELOPER TO PROVIDE THE CLEARING AND GRUBBING CONTRACTOR WITH A COPY OF THE ESC PERMIT INCLUDING DRAWINGS.
- THE GENERAL CONTRACTOR TO CONFIRM ESC PERMIT HAS BEEN ISSUED, THERE IS A COPY ON SITE, AND THE PERMIT SIGNAGE IS ERECTED AT THE SITE ENTRANCE.
- SHOULD THE SITE CONTAIN OR BE ADJACENT TO A PARK, THE CLEARING AND GRUBBING CONTRACTOR MUST CONTACT THE REGIONAL DISTRICT OF THE CENTRAL OKANAGAN TO DISCUSS THE REMOVAL OF HAZARDOUS TREES.
- PERIMETER ESC MEASURES TO BE INSTALLED AFTER MEETING WITH PARKS AS APPLICABLE AND PRIOR TO INITIATING ON-SITE CLEARING AND GRUBBING.
- INSTALL PROTECTIVE MEASURES AT OR WITHIN EXISTING CATCH/LAWN BASINS AND STORM GRATES AS APPLICABLE.
- INSTALL SPECIFIED ESC ACCESS FACILITIES/MEASURES AT ENTRY/EXIT POINTS. ALL VEHICLE MOVEMENT TO AND FROM THE SITE IS TO BE RESTRICTED TO CONTROLLED ENTRY/EXIT POINTS.
- PRIOR TO LEAVING THE SITE, ON-SITE CLEARING AND GRUBBING CONTRACTOR TO OBTAIN SIGN OFF BY THE ESC SUPERVISOR.
- DEVELOPER WILL BE RESPONSIBLE TO PROVIDE A COPY OF THE ESC PLAN AND PERMIT TO THE GENERAL CONTRACTOR.
- GENERAL CONTRACTOR TO HAVE A COPY OF THE ESC PLAN AND PERMIT ON-SITE AT ALL TIMES, AND ENSURE ESC SIGNAGE IS IN PLACE.
- ON-SITE STORM WATER CONTROL FACILITIES COMPLETE WITH VELOCITY CONTROL MEASURES TO BE INSTALLED AS ROADWAYS ARE STRIPPED.
- ANY STOCKPILED MATERIAL TO BE COVERED AND ENCIRCLED BY SEDIMENT FENCE AS SPECIFIED.
- THE ESC SUPERVISOR WILL BE RESPONSIBLE FOR REVIEWING THE EXISTING ROADS DAILY AND THAT THE GENERAL CONTRACTOR SWEEPS THEM REGULARLY. FLUSHING OF ROADWAYS IS PROHIBITED.
- UPON THE COMMENCEMENT OF WORKS, ESC SUPERVISOR TO CONDUCT MONITORING AS PER THE CITY KELOWNA MONITORING AND REPORTING REQUIREMENTS.
- INSTALLATION OF FILTER BERMS, FILTER RINGS AND CATCH BASIN PROTECTION SHALL BE AS PER MANUFACTURER'S SPECIFICATIONS.
- CONTRACTOR TO IDENTIFY LOCATION OF TEMPORARY STOCKPILES ON PLAN FOR REVIEW BY ESC SUPERVISOR PRIOR TO STOCKPILING.
- DURING EXCAVATION, DEWATERING SUMPS ARE TO BE INSTALLED AS NECESSARY. DEWATERING SUMPS WILL CONSIST OF A VERTICAL PERFORATED PIPE SURROUNDED BY DRAIN ROCK WITH A NON-WOVEN GEOTEXTILE TO SEPARATE THE NATIVE SOIL FROM THE DRAIN ROCK.
- DEWATERING WHERE REQUIRED SHOULD BE PUMPED TO FILTER BERM. ADDITIONAL BERMS TO BE INSTALLED IF REQUIRED.
- DEWATERING TO BE PUMPED TO TEMPORARY TANKS ON-SITE IF CAPACITY OF FILTER BERM IS EXCEEDED OR IS DEMONSTRATED TO BE INEFFECTIVE.

UTILITY AND ROADWORKS INSTALLATION STAGE

- CONTRACTOR TO INSTALL TEMPORARY SEDIMENT CONTAINMENT AND CONTROL MEASURES AS SPECIFIED IN THE APPROVED ESC PLAN AND AS DIRECTED BY THE ESC SUPERVISOR.
- CONTRACTOR TO INSTALL ADDITIONAL SEDIMENT FENCING OR BERMS AS INDICATED ON THE ESC PLAN AND AS DIRECTED BY THE ESC SUPERVISOR.
- ALL ACCESS TO AND FROM SITE TO BE FROM THE RESTRICTED ENTRY-EXIT POINTS.
- ESC SUPERVISOR TO CONDUCT MONITORING AS PER THE CITY OF KELOWNA MONITORING AND REPORTING REQUIREMENTS.
- CONTRACTOR TO ENSURE THAT THE ESC MEASURES ARE WELL MAINTAINED, CLEARED, REPAIRED, OR REPLACED AS REQUIRED.
- CATCH/LAWN BASINS COMPLETE WITH PROTECTIVE MEASURES ARE TO BE INSTALLED BY THE CONTRACTOR AT THE FIRST OPPORTUNITY.
- CONTRACTOR TO CO-ORDINATE THE ELIMINATION OF TEMPORARY ESC FACILITIES IF THEY ARE NO LONGER REQUIRED OR TO FACILITATE SITE OPERATIONS WITH THE ESC SUPERVISOR. ADDITIONAL ESC FACILITIES MAY NEED TO BE INSTALLED AS PER THE DIRECTION OF THE ESC SUPERVISOR.

FINAL GRADING STAGE THROUGH TO SUBSTANTIAL COMPLETION

- GENERAL CONTRACTOR TO ENSURE THAT STORMWATER CONVEYANCE CHANNELS AND DISCHARGE POINTS TO ADJACENT STREAMS, DITCHES, OR ENTRY POINTS TO PIPED NETWORKS, ARE ADEQUATELY PROTECTED.
- CONTRACTOR TO ENSURE THAT ESC FACILITIES SPECIFIED IN THE ESC PLAN ARE IMPLEMENTED ACCORDINGLY.
- AFTER FINAL GRADING IS COMPLETED ALL DISTURBED AREAS ARE TO BE PROTECTED AS PER THE ESC PLAN.
- CONTRACTOR TO CO-ORDINATE THE ELIMINATION OF TEMPORARY ESC FACILITIES AS THEY ARE NO LONGER REQUIRED; WITH THE ESC SUPERVISOR. ADDITIONAL ESC FACILITIES MAY NEED TO BE INSTALLED AS PER THE DIRECTION OF THE ESC SUPERVISOR.
- AT THE FINAL SITE INSPECTION PRIOR TO THE COMMENCEMENT OF THE MAINTENANCE PERIOD; ESC SUPERVISOR IN ASSOCIATION WITH DRAINAGE AND ENVIRONMENT STAFF TO INSPECT AND SIGNOFF ON ESC MEASURES.
- UPON COMPLETION OF THE PROJECT AND AFTER PERMANENT BEST MANAGEMENT PRACTICES FOR EROSION CONTROL ARE ESTABLISHED, THE COMPOST FILTER SOCK MESH AND NETTING SHOULD BE REMOVED FROM SITE. THE COMPOST FILTRATION MEDIA SHALL BE DISPERSED ON-SITE, SUBJECT TO REVIEW BY THE PROJECT ENGINEER.

PRODUCT SPECIFICATIONS

NILEX CIVIL ENVIRONMENTAL GROUP
Unearthing better results.

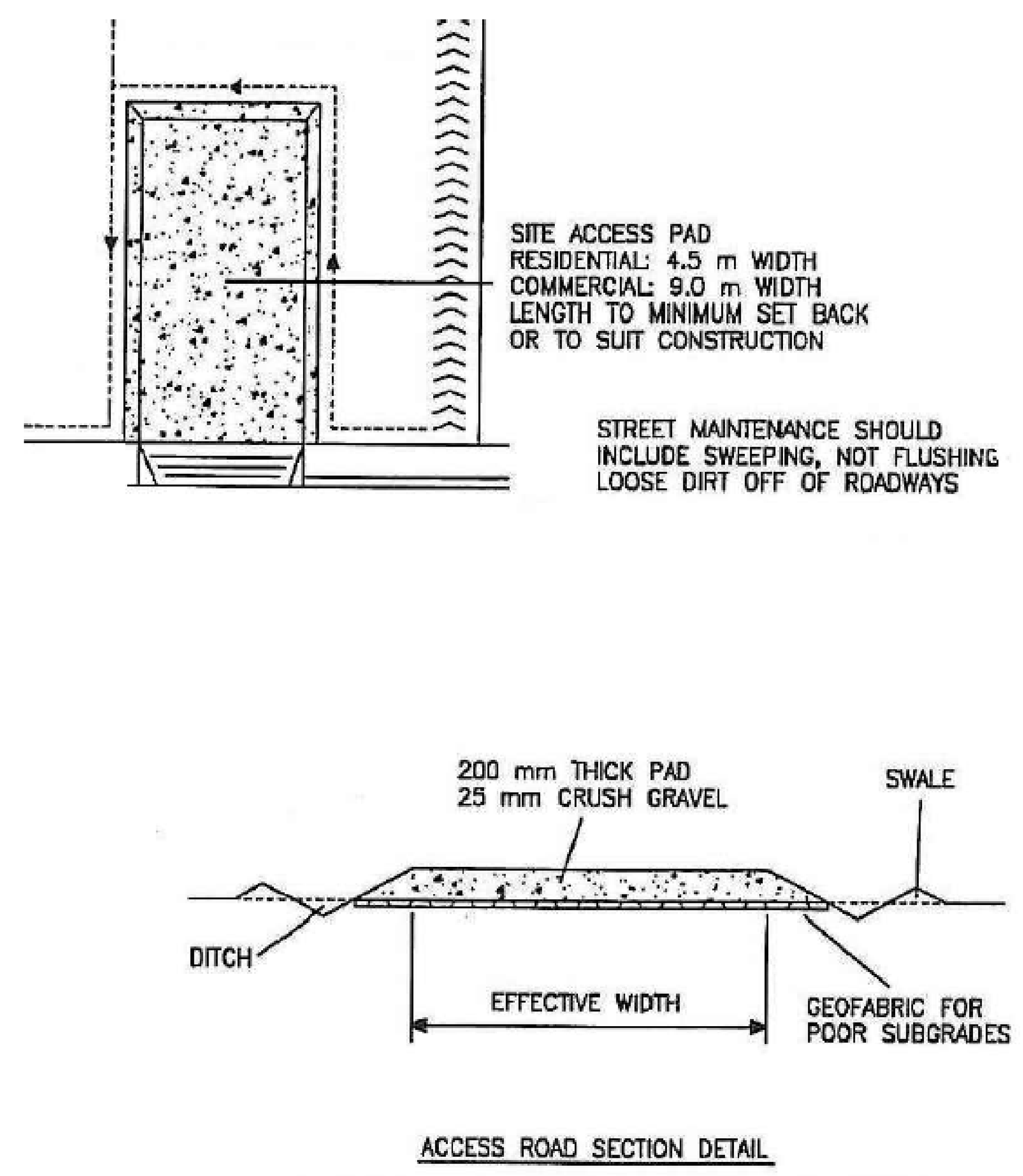
Nilex Silt Fence

Property	Test	Unit	Value
Mechanical			
Grab Tensile Strength (MD/XD)²	ASTM D-4632	N (lb)	550 x 550 (124 x 124)
Grab Elongation (MD/XD)²	ASTM D-4632	%	15 x 20
Puncture Strength	ASTM D-4833	N (lb)	285 (65)
Mullen Burst	ASTM D-3786	kPa (psi)	2060 (300)
Trapezoidal Tear	ASTM D-4533	N (lb)	285 (65)
Hydraulic			
Apparent Opening Size (AOS)	$\frac{\text{opening area}}{\text{total area}} \times 100$	mm (US Sieve)	0.600 (30)
Permittivity	ASTM D-4491	sec^{-1}	0.1
Water Flow Rate	ASTM D-4491	$l/min/m^2$ (gpm/ft^2)	325 (8)
Endurance			
UV Resistance	ASTM D-4355	% @ 500 hrs	80
Packaging			
Roll Width	Measured	m (ft)	0.91 (3)
Roll Length	Measured	m (ft)	30.48 (100)
Roll Weight	Calculated	kg (lb)	47 (103)

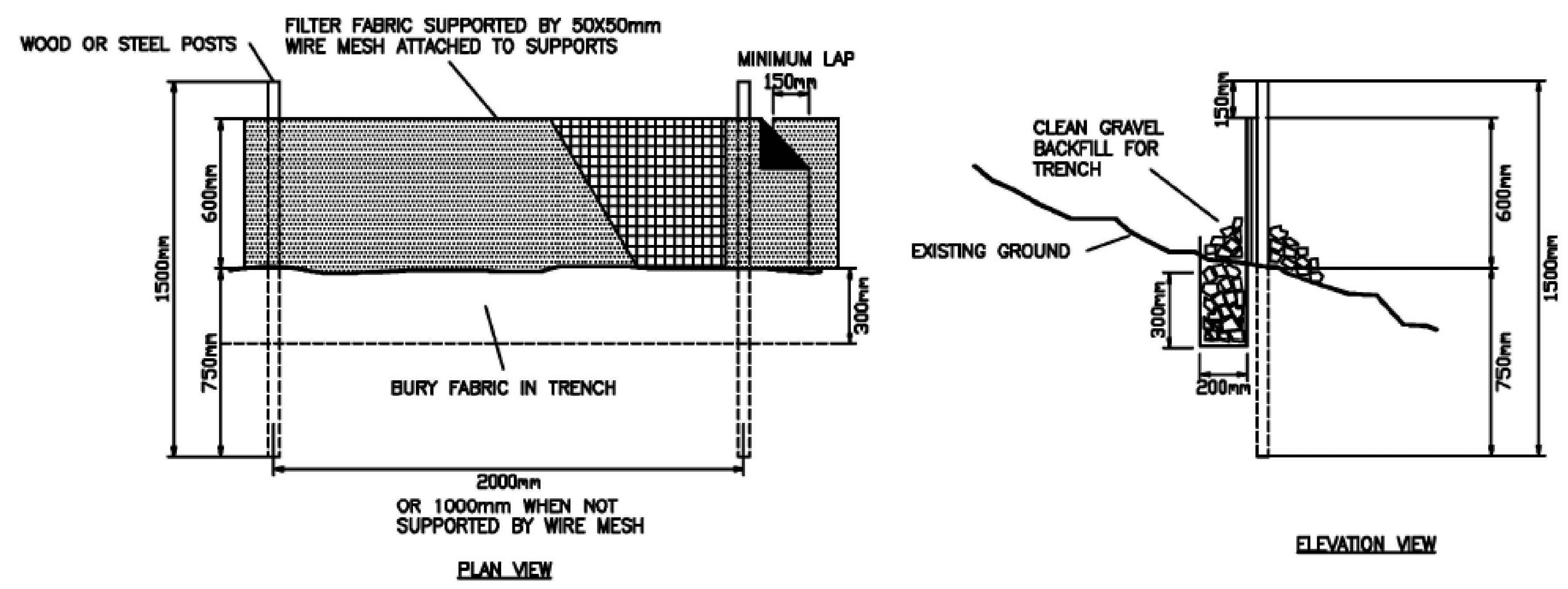
Disclaimer: The information provided by Nilex is believed to be correct and is generally based on information supplied by the manufacturers of the product offered. Any recommendations made by Nilex concerning uses or applications of our products are also believed to be reliable; however, as Nilex has no control over design execution, and field conditions of the project which incorporate the product. Nilex disclaims all warranties, expressed or implied, including, without limitation, the warranties of merchantability and/or fitness for a particular purpose.

EROSION & SEDIMENT CONTROL — nilex.com

A / C501 **NILEX SILT FENCE SPECIFICATIONS**
SCALE: nts



B / C501 **ACCESS ROAD SECTION**
SCALE: nts



C / C501 **NILEX SILT FENCE DETAIL**
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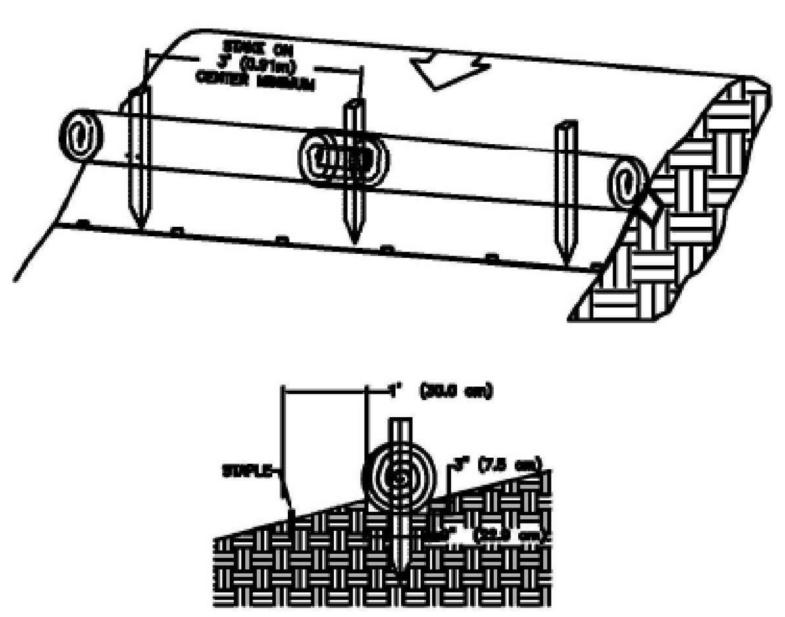

D / C501 **SLOPE SEDIMENT BARRIER**
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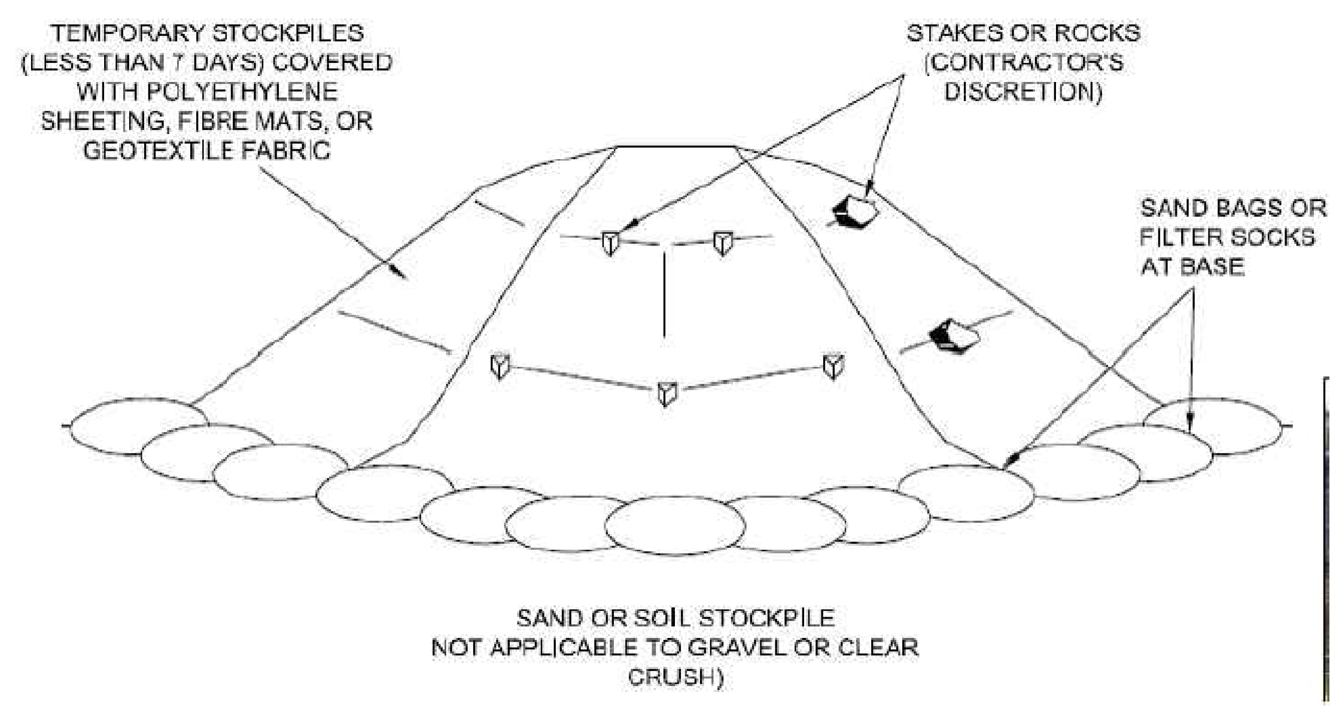

E / C501 **TEMPORARY STOCKPILES**
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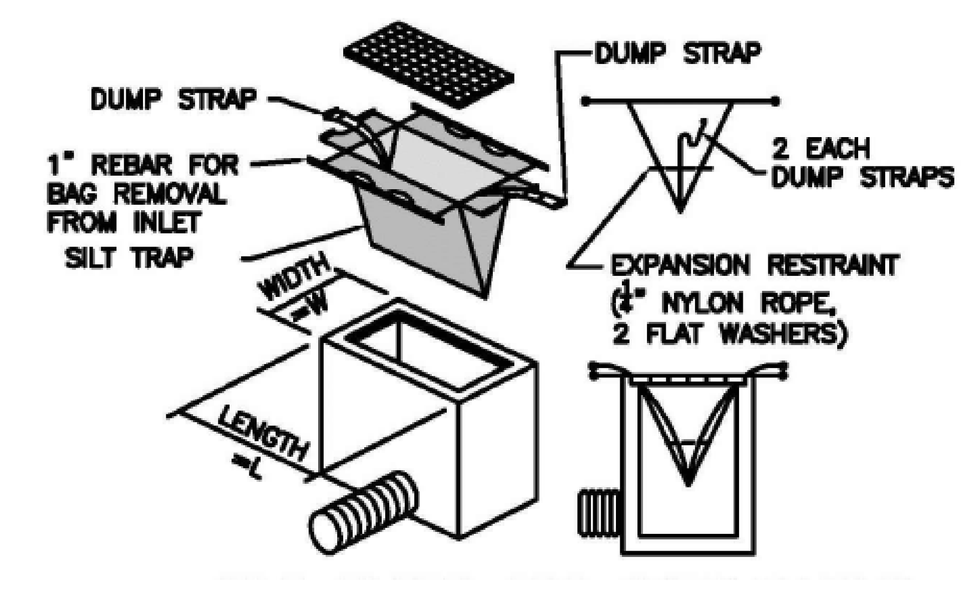

NOTE: SILT FILTER TO BE SHAPED TO FIT DISTRICT'S STANDARD CATCHBASINS

F / C501 **SILT FILTER FOR CATCHBASINS**
SCALE: nts

ISSUED FOR DEVELOPMENT PERMIT 16-07-15

LEGEND

EX. SEWER PIPE
EX. SANITARY SEWER PIPE
EX. WATER PIPE
PROP. STORM SEWER PIPE
PROP. SANITARY SEWER PIPE
PROP. WATER PIPE
PROP. ELEVATION
EX. ELEVATION

MANHOLE — M.H.
UTILITY POLE — U.P.
POWER POLE — P.P.
LAMP STANDARD — L.S.
CATCH BASIN — C.B.
HYDRANT — HYD
TREES — T
SURVEY MONUMENT

NAD 83
INSERTION BASE POINT= 0 , 0

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BASE JRG | DESIGN JRG
APPROVED SB
DATE JUNE 15 2016
SCALE: SCALE NOT ACCURATE OVER LONG DISTANCES

THE REGIONAL DISTRICT OF THE CENTRAL OKANAGAN
DESIGN AND CONSTRUCTION
ACORN RESORTS LIMITED PARTNERSHIP
SUNSET RANCH STAGE 6 — PHASE ONE
EROSION AND SEDIMENT CONTROL DETAILS

DIVISION: MUNICIPAL
DRAWING NO.: C501
REV NO: 0

ORIFICE SIZING CALCULATION:

Diameter	0.112	m	
C	0.61		Coefficient
A	0.00985	m	Area
g	9.81	m/sec	Gravity
h	1.65	m	Head
Q	0.034	m³ / sec	
	34.2	**liters / sec**	

$$Q = CA\,\mathrm{sqrt}(2gh)$$

NOTE:
REQUIRED STORAGE FOR 100 YEAR 1 HOUR STORM EVENT = 62.3m³
PROVIDED STORAGE = 65.6m³
PRE-DEVELOPMENT 5 YEAR STORM ALLOWABLE RELEASE RATE = 34 l/s
PIPES SIZED FOR 100 YEAR 1 HOUR STORM EVENT

CITY OF KELOWNA

PHASE ONE STORM DESIGN

(PROPOSED DESIGN)

C = runoff coefficient
A = area (ha)

$Q = 2.778\,CIA$ (l/s) = Storm Flow

$I_{(5)} = 12.2(T)^{-0.723}$ (mm/h) = Rainfall Intensity (5 year)

$I_{(100)} = 21.3(T)^{-0.767}$ (mm/h) = Rainfall Intensity (100 year)

$g = 9.81$ m³/s
Manning's n = 0.013 (Conc.)
Manning's n = 0.011 (PVC)

Design Sheet No: 1 of 1
Project Name: Sunset Ranch Phase One
Project no.: 5115-067-000
Designed by: NS
Chk'd. by:
Date: 18-Jul-16

STREET	MANHOLE FROM	MANHOLE TO	LENGTH (m)	INCREMENT C	INCREMENT Area A (ha)	INCREMENT CA	CUMULATIVE A (ha)	CUMULATIVE CA	FLOW TIME (min) TO SECTION	FLOW TIME (min) IN SECTION	$I_{(5)}$ mm/hr	$I_{(100)}$ mm/hr	Q m³/s	S%	D mm	TYPE OF PIPE	Q FULL m³/s	ACTUAL DEPTH,d m	ACTUAL VELOCITY m/s	% FULL	V FULL m/s
Seminole Road	4	3	73	0.50	0.30	0.15	0.30	0.15	10.00	0.58	44.56	84.18	0.04	3.00	250.0	PVC	0.12	0.09	1.78	28.8%	2.10
Seminole Road	3	2	147	0.50	0.30	0.15	0.60	0.30	10.58	0.86	42.78	80.62	0.07	5.50	250.0	PVC	0.16	0.11	2.70	40.8%	2.84
Seminole Road	2	1	29	0.50	0.66	0.33	1.26	0.63	11.44	0.17	40.43	75.92	0.13	0.50	1500.0	Conc	5.00	0.18	1.16	2.7%	2.83
Seminole Road	1	Creek	25	0.50	0.13	0.07	1.39	0.70	11.61	0.49	40.00	75.06	0.03	0.50	250.0	PVC	0.05	0.15	0.93	68.4%	0.86

0 15 30 45 60 75m
SCALE: 1:750

ISSUED FOR DEVELOPMENT PERMIT 16-07-15

LEGEND
EX. SEWER PIPE
EX. SANITARY SEWER PIPE
EX. WATER PIPE
PROP. STORM SEWER PIPE
PROP. SANITARY SEWER PIPE
PROP. WATER PIPE
PROP. ELEVATION (XXX.XX)
EX. ELEVATION XXX.XX

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UTILITY POLE U.P.
POWER POLE P.P.
LAMP STANDARD L.S.
CATCH BASIN C.B.
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SURVEY MONUMENT

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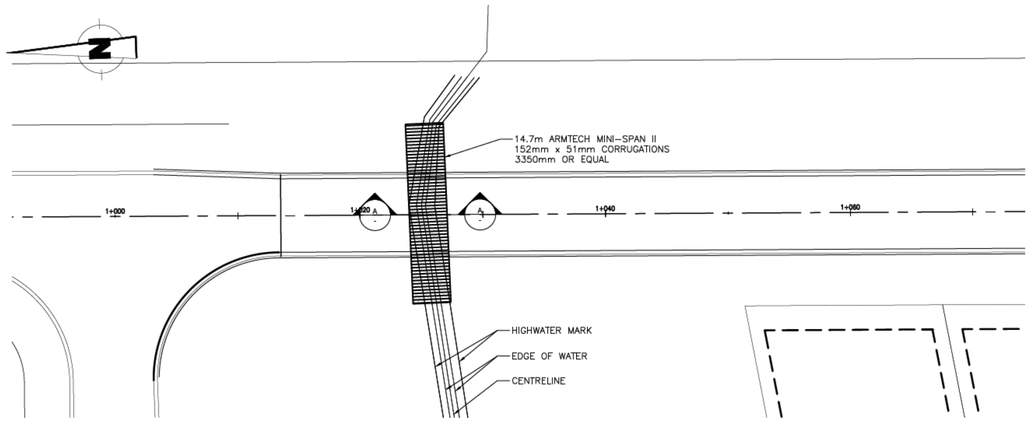
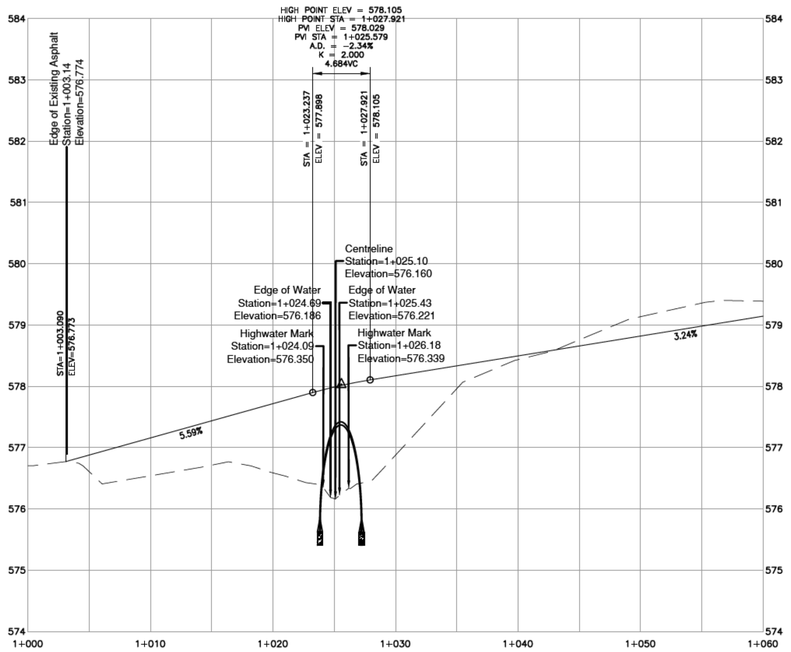
DESIGN AND CONSTRUCTION

ACORN RESORTS LIMITED PARTNERSHIP
SUNSET RANCH STAGE 6 – PHASE ONE

PHASE ONE MINOR STORM DRAINAGE

DIVISION: MUNICIPAL
DRAWING NO.: C600
REV NO: 0





A-A SEMINOLE ROAD STREAM CROSSING PROFILE

SCALE: H: 1:250 V: 1:50

ISSUED FOR DEVELOPMENT PERMIT 16-07-15

LEGEND

EX. SEWER PIPE	
EX. SANITARY SEWER PIPE	
EX. WATER PIPE	
PROP. STORM SEWER PIPE	
PROP. SANITARY SEWER PIPE	
PROP. WATER PIPE	
PROP. ELEVATION	XXXXX
EX. ELEVATION	XXX.XX

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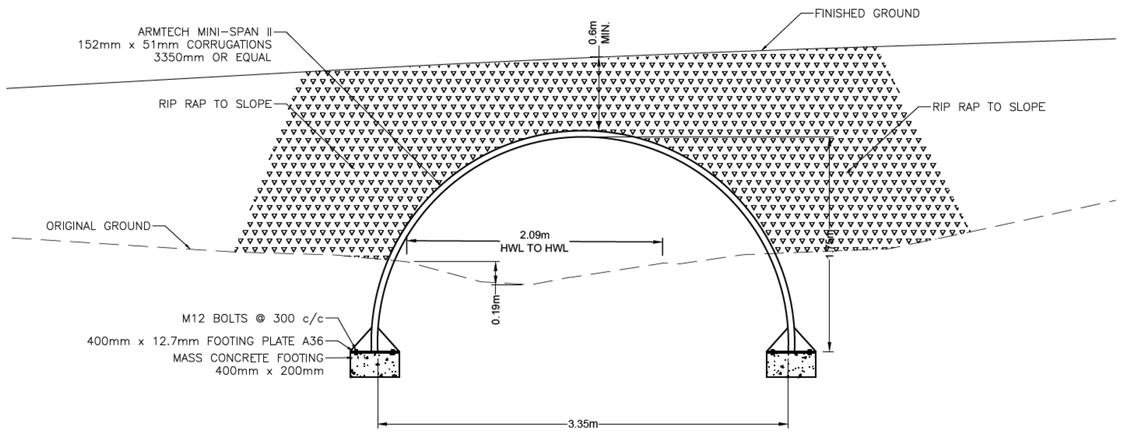
ACORN RESORTS LIMITED PARTNERSHIP
SUNSET RANCH STAGE 6 – PHASE ONE
SEMINOLE ROAD CROSSING
PLAN AND PROFILE

DIVISION: MUNICIPAL
DRAWING NO.: C700
REV NO: 0



STREAM CROSSING DETAIL

SCALE: 1:25

ISSUED FOR DEVELOPMENT PERMIT 16-07-15

LEGEND

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EX. SANITARY SEWER PIPE
EX. WATER PIPE
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LAMP STANDARD L.S.
CATCH BASIN C.B.
HYDRANT HYD
TREES
SURVEY MONUMENT

NAD 83

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Locations and offsets of existing utilities shown on this plan are not guaranteed to be accurate and must be verified in the field PRIOR TO CONSTRUCTION. The City of Kelowna does not guarantee their accuracy. Concerned persons should not rely on these documents and should verify all information shown by way of site survey and other appropriate methods. The City of Kelowna accepts no liability for use of these files or information.

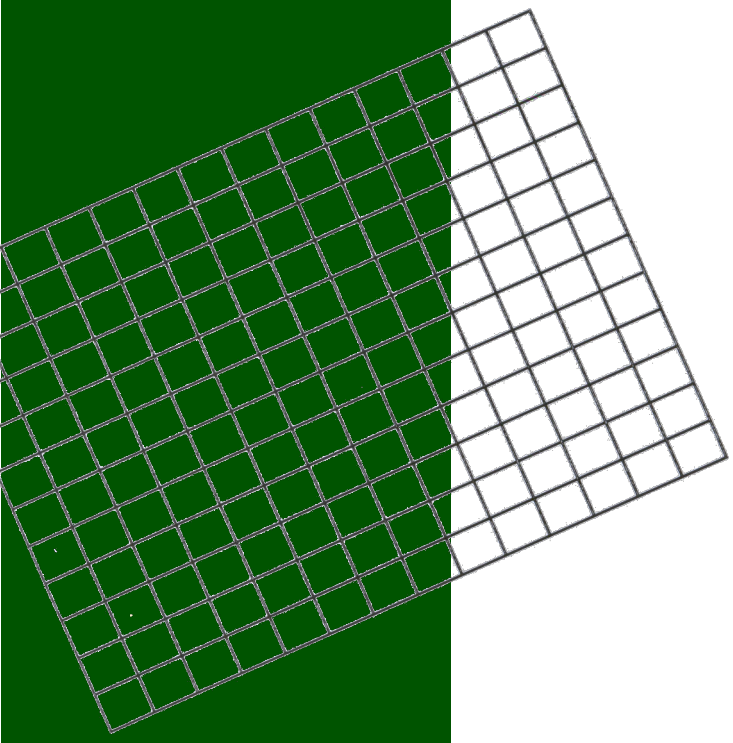
NO.	DATE	BY	REVISION	CH'KD
0	2016-07-15	NS	ISSUED FOR DEVELOPMENT PERMIT	SB

WSP
ENGINEERING • PLANNING • GEOMATICS
#602-1708 DOLPHIN AVENUE
KELOWNA BC, V1Y 9S4
PHONE (250) 980-5500
FAX (250) 980-5511

BASE JRG DESIGN JRG
APPROVED SB
DATE JUNE 15 2016
SCALE
SCALE NOT ACCURATE OVER LONG DISTANCES

THE REGIONAL DISTRICT OF THE CENTRAL OKANAGAN
DESIGN AND CONSTRUCTION
ACORN RESORTS LIMITED PARTNERSHIP
SUNSET RANCH STAGE 6 – PHASE ONE
SEMINOLE ROAD CROSSING
DETAILS

DIVISION: MUNICIPAL
DRAWING NO.: C701
REV NO: 0



SERVICING BRIEF

SUNSET RANCH
PHASES 6.0, 6.1 & 6.2
Proposed 60-Lot Subdivision
Sunset Ranch Drive, Kelowna

For Review by:

Sunset Two Properties Ltd.

Submitted by:

Alpine Consultants Ltd.

1998 Vernon Street
Lumby, BC V0E 2G0
Ph: 250-870-6261
Permit to Practice: 1000176
James B. Kay, P.Eng
JKay@AlpineConsultants.ca

Alpine Project No: 2021-085
February 6, 2022

February 6, 2022

ALPINE
Consultants Ltd.

Sunset Two Properties
3744 Seminole Road
Kelowna BC V1W 4B4

Alpine Project No:2021-085
Permit to Practice: 1000176

Attention: **Mr. Greg Bird**
President

Dear Sirs:

Re: **Servicing Brief**
Sunset Ranch Phases 6.0, 6.1 & 6.2
Proposed 60-Lot Residential Subdivision

Alpine Consultants Ltd. is pleased to provide this servicing brief in support of the proposed sixty (60) lot residential subdivision. This brief outlines the proposed servicing strategy and adequacy of existing infrastructure to support a residential development, part of an overall master-planned community, at Sunset Ranch in Kelowna, BC.

Sunset Phase 6.0 is proposed as a mix of Duplex and Single-family homes totalling 60 units, connecting to utility services planned and installed in previous development phases in Sunset Ranch Drive, and soon to be installed through Stage 4.4 and 4.3. The services had therefore been anticipated and calculations undertaken in the overall planning. This servicing brief will complement the existing planning documentation and confirm the capacity of the existing and proposed infrastructure.

Please feel free to contact me should you require any additional information or clarification. We will make ourselves available at your convenience should you wish to get together to discuss the brief further. Otherwise, we thank you for this opportunity to complete this Servicing Brief and we look forward to working with you as this project progresses

Yours truly,
ALPINE CONSULTANTS LTD.

James Kay

Jason Angus
Project Coordinator/Design Technologist

James Kay, P.Eng
Principal/Project Manager

CC: Mr. Michael Noga, RDCO

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Page No.

LIST OF APPENDICES

1.0 INTRODUCTION

Alpine Civil Engineering Consultants Ltd. is pleased to provide this servicing brief in support of the proposed sixty (60) lot residential subdivision. This brief outlines the proposed servicing strategy and adequacy of existing infrastructure to support a residential development, part of an overall master-planned community, at Sunset Ranch in Kelowna BC.

This Servicing Brief addresses the road, water, sanitary and storm infrastructure, lot grading, storm water management, and shallow utilities associated with the proposed development.

1.1 BACKGROUND

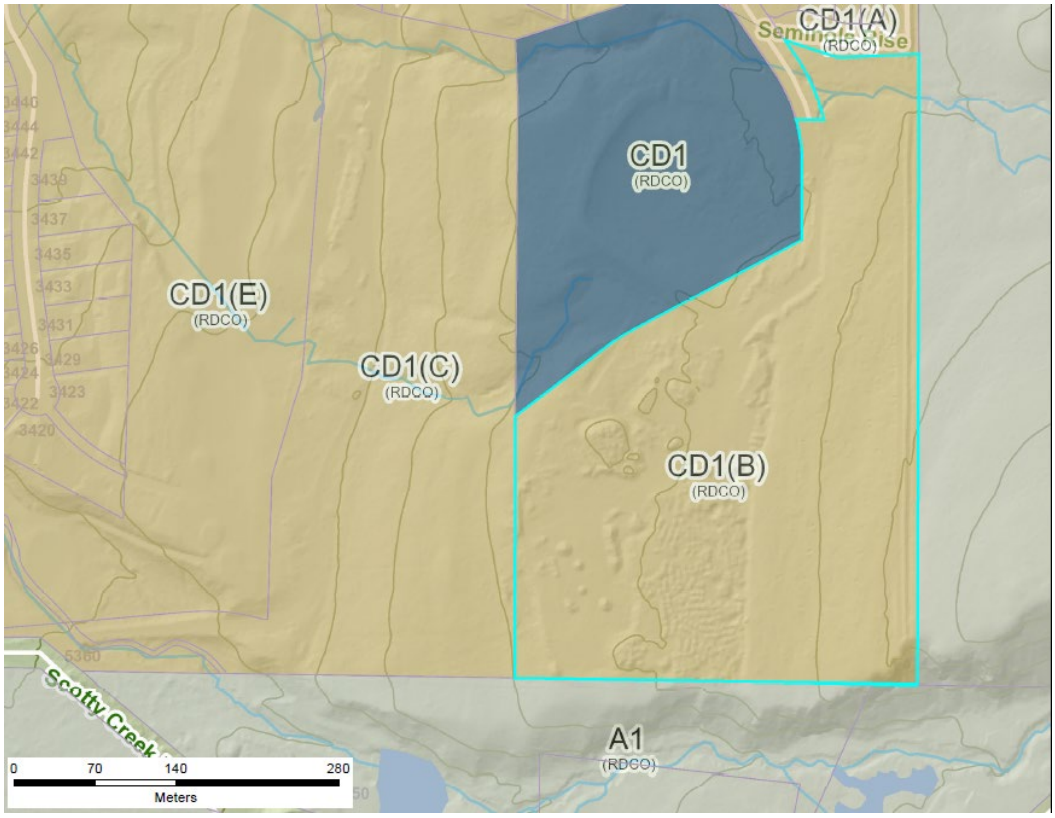
Alpine Consultants Ltd. has been engaged by our client, Sunset Two Properties Ltd, to develop a sixty (60) lot residential development complete with engineering design and support.

1.2 SITE DESCRIPTION

The Property is zoned CD1(B) and measures 13.442 acres. The site is currently an undeveloped area with a gravel surfaced road though the property, and two creeks that cross, Rockface Creek and a tributary to Rockface Creek. Utilities have been constructed to the north property line in previous phases, and will be extended as part of Stage 4.3 & 4.4. As-builts have been provided to show the locations of the utilities.

1.3 DEVELOPMENT CONCEPT

It is proposed to develop the residential development as an extension to the previous phase on Sunset Ranch Drive. Servicing the new development will be an extension to the utilities at the south end of Sunset Ranch Drive and through Stage 4.3 & 4.4.



2.0 STUDY METHODOLOGY & RESOURCES

This servicing brief has analyzed the existing and adjacent infrastructure for suitability of servicing the next phase of development along Sunset Ranch Drive. We have investigated and located the existing offsite infrastructure using area maps as-built drawings, and survey. We have reviewed existing bylaws and studies to establish the required levels of service and constraints. We have compiled and reviewed all available, relevant information to try to identify any constraints in the existing and proposed infrastructure.

2.1 SUBDIVISION & DEVELOPMENT SERVICING BYLAW

The design, approval, and construction of Phase 6.1, 6.2 and 6.3 are governed by the Regional District of Central Okanagan's Subdivision, Development and Servicing Bylaw #1397, 2016.

Review of this Bylaw establishes minimum levels of service and performance of the engineering infrastructure in public rights-of-way. By no means is this intended to be a comprehensive synopsis of this extensive document, however, it provides valuable information as to whether the existing infrastructure may be suitable to service the proposed development.

Highlights of the Bylaw include the following:

Water

- *For Residential Areas*
  - *Average day demand: 900 l/capita/day*
  - *Maximum Day demand: 2100 l/capita/day*
  - *Peak hour demand: 3600 l/capita/day*
- *Fire Flows*
  - *Residential: 60l/s*

At the south end of Sunset Ranch Drive, there is an existing 200mm water main that can be utilized to extend into the next phase of development.

Sanitary

- *Domestic Flow Rate: 300l/capita/day*
- *Infiltration rates: 5000l/ha/day*
- *Design Capita: 60 properties x 3 people/unit = 180 people*
- *Peaking Factor is calculated by using the Harmon Equation*
- *Pipes sizes must be selected so that the sewers flow 2/3 to 3/4 full at peak hour design flow.*
- *Minimum Velocity: 0.6m/s*

At the south end of Sunset Ranch, there is an existing 200mm sanitary sewer main that can be utilized to extend into the next phase of development however the proposed sanitary system would be better suited to flow through the phase 4.3 & 4.4 system. This phase has been designed to handle the additional flows from phases 6.1, 6.2 and 6.3.

Storm Drainage

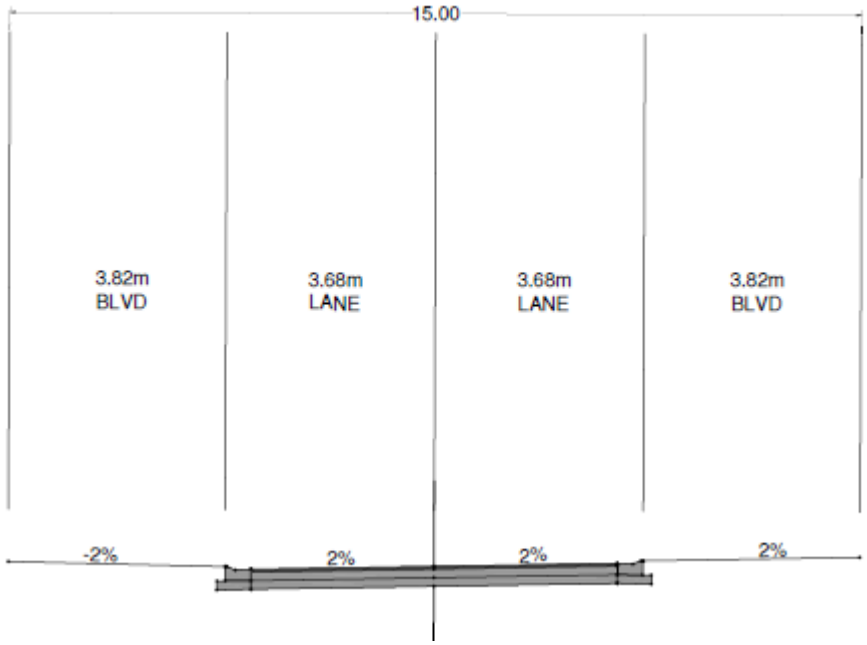
- *Rational Method acceptable for small watersheds (10ha or less)*
- *Minor Drainage System designed for 5-year return frequency*
- *Major Drainage System designed for 100-year return frequency*
- *Stormwater management systems must incorporate such techniques as lot grading, surface infiltration, and sub-surface disposal, storage, or other acceptable methods to limit the peak run-off from the development (100-yr) to pre-development flows (5yr)*

As offsite improvements Alpine Consultants are proposing the construction of rock pits for the properties that may be higher than the storm system and underground storage tanks to control the drainage runoff from the road network and the properties that are able to connect to the system. This storm network is proposed to function as a standalone piece of infrastructure and will be designed to release at a pre-development rate into Rockface Creek.

A detailed SWMP Brief will accompany the detailed civil engineering submission.

Roads

Sunset Ranch Drive is already existing from a previous phase. Phase 6.0 will see the extension of Sunset Ranch Drive to the south as well as the continuation of Seminole Road to the south. These will be newly constructed roads complete with curb gutter and storm drainage system. Driveway access will be constructed to each residential unit.



Phases 6.1, 6.2 and 6.3 are designed for residential, containing 60 properties, and therefore is expected to have a minimal impact to the surrounding transportation network. Additionally once phase 6.0 is constructed there will be no more future phases south of this phase. Phase 4.4 and its 8 units will connect through Phase 6.

3.0 ENGINEERING INFRASTRUCTURE ANALYSIS

As noted, this servicing brief has analyzed the existing and adjacent infrastructure for suitability of servicing the next phase of Sunset Ranch. The detailed set of drawings will be provided for further information in support of phase 6.1, 6.2 and 6.3 subdivision. The following is to provide a level of detail as appropriate.

3.1 WATER SYSTEMS DEMAND

Based on the Subdivision & Development Servicing Bylaw information in section 2.1, it is expected that fire flows of 60L/s will be required, and that based on the mechanical fixture unit calculations it is approximated the next phase of trickle Creek will require the flows of:

- Average Daily Demand = 180 People x 900 L/c/d/ (24x60x60) = 1.91 L/s
- Maximum Day Demand = 180 people x 2100L/c/d/ (24x60x60) = 4.38 L/s

- Peak Hour Demand = 180 people x 3600L/c/d/ (24x60x60) = 7.5 L/s
- Fire Flow = 60L/s

It is proposed to provide a 200mm PVC watermain, connecting to the existing watermain in Sunset Ranch Drive and extending to the south for the next phase of the subdivision. Fire hydrants will be provided along the new Sunset Ranch Drive to provide the required coverage.

3.2 SANITARY SEWER SYSTEM DEMAND

Based on the Subdivision & Development Servicing Bylaw information in section 2.1, the 3.751 Ha phase of Sunset Ranch will generate flows of:

- Average Daily Flow = 180 people x 300L/c/d/ (24x60x60) = 0.625 L/s
- Infiltration Flow = 3.751Ha x 5000L/Ha/d/ (24x60x60) = 0.22 L/s
- Peaking Factor = 75% x 1+14/(4+√P) = 0.75x(1+14/ (4+√ (180/1000)) = 3.1
- Peak Flows = 0.625L/s x 3.1 = 1.94/s + 0.22L/s = 2.16 L/s

It is proposed to provide a 200mm PVC sanitary sewer main, connecting to the existing sanitary sewer main in Trickle Creek Drive.

3.3 STORM DRAINAGE CAPACITY & STORM WATER MANAGEMENT

Alpine Consultants will utilize a wide range of Best Management Practices pertaining to the storm water management. These will focus on the three areas of practice: peak flow attenuation, volume reduction, and storm water quality. It is proposed that the storm management system should include:

- Lot level retention and detention on the site through rock pits, underground chambers, etc. A downstream detention facility will be considered. Some of these systems will either be owned by property owners or the RDCO.

Alpine Consultants will provide an overall storm runoff strategy under separate cover. In summary the required storm storage for the initial Phase is approximately 318.5 cubic meters and will be provided in a combination of rock pits, perforated pipes and underground chambers with outflow being limited to Rockface Creek.

3.4 SHALLOW UTILITIES

There are known underground utilities with the existing phase of Trickle Creek. These utilities will be extended into the new phase. All servicing to the new phase and the proposed properties will be underground as per requirements. This shall include but not limited to:

- Electrical
- Telephone
- Cable TV
- Gas

4.0 CONCLUSIONS, RECOMMENDATIONS AND FURTHER STUDY

Alpine Consultants Ltd. have taken a comprehensive review of the proposed phase 6.1, 6.2 and 6.3 of Sunset Ranch as well as the pertaining information to the existing infrastructure and down stream capacities. In Alpine Consultants' opinion, there are no capacity restraints that would prohibit the next phase of the development.

4.1 DEVELOPMENT PROCESS

From an engineering perspective, phases 6.1, 6.2 and 6.3 of this site could proceed on the aforementioned basis, providing infrastructure and services to future development lands, without hindering future decisions.

4.2 GEOTECHNICAL ASSESSMENT

A geotechnical assessment has been completed. Design & construction works are proposed in accordance with the geotechnical assessment.

4.3 CONCLUSION

Review and assessment of the existing Water, Sanitary, Storm, and Road infrastructure indicates that the proposed phase 6.1, 6.2 and 6.3 of Sunset Ranch can be supported with relative extensions of the existing utilities. As such, from an engineering and servicing infrastructure perspective, there are no technical constraints that would preclude or prevent this phase from proceeding.

Yours truly,

ALPINE CIVIL ENGINEERING CONSULTANTS LTD.

James Kay

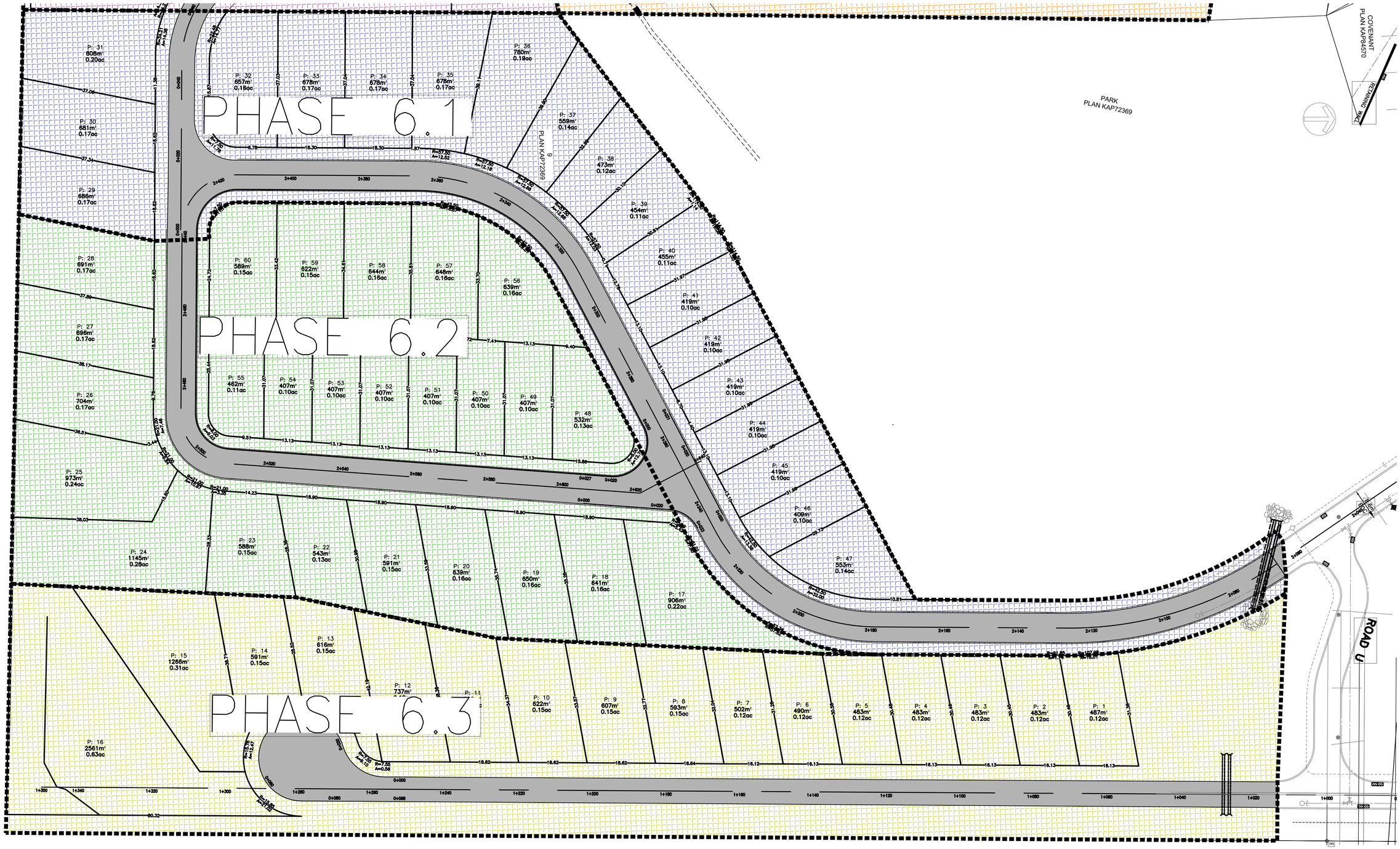
Jason Angus
Project Coordinator/Design Technologist

James B. Kay, P.Eng.
Principal

CC: Mr. Michael Noga, RDCO

APPENDIX I

INFRASTRUCTURE DRAWINGS



NOTICE TO CONTRACTOR

IT IS THE RESPONSIBILITY OF THE CONTRACTOR'S SURVEYOR TO VERIFY THAT ALL LEGAL SURVEY DIMENSIONS SHOWN ON THE ENGINEERS DRAWINGS AGREE WITH THOSE ON THE REGISTERED LEGAL SURVEY PLAN. SHOULD THERE BE ANY DISCREPANCIES, THEN IMMEDIATELY NOTIFY THE ENGINEER OF RECORD

LEGAL DESCRIPTION: LOT 9, PLAN KAP72369, SECTION 7, TOWNSHIP 24, LAND DISTRICT 41 & AN UNDIVIDED 1/7 SHARE IN LOT 2

B.M. MONUMENT NO. ELEVATION:

LOCATED AT STREET & AVENUE

REV. NO.	DESCRIPTION	DR	CH	DATE	APP

ALPINE CONSULTANTS LTD
1998 VERNON ST, LUMBY, BC V0E 2G0, CANADA
Tel: 250-870-6261, E-mail: general@alpineconsultants.ca
Permit to Practice: 1000176

CLIENT:
ACORN COMMUNITIES LTD.
3744 SEMINOLE ROAD, KELOWNA, BRITISH COLUMBIA, CANADA V1X 8G9
PH. 250-491-0095

PROJECT:
SUNSET RANCH STAGE 6: PROPOSED 60 LOT SUBDIVISION
3600 SUNSET RANCH DRIVE, KELOWNA, BRITISH COLUMBIA, CANADA V1X 8C7
PID: 025-561-529

The location of existing underground utilities are shown in an approximate way only & have not been independently verified by the owner or its representative. The contractor shall determine the exact location of all existing utilities before commencing work, and agrees to be fully responsible for any and all damages which might be occasioned by the contractor's failure to exactly locate and preserve any and all underground utilities.

TITLE:
PHASING PLAN

PROJECT NO.

SCALE
HORZ. 1:500
VERT. –

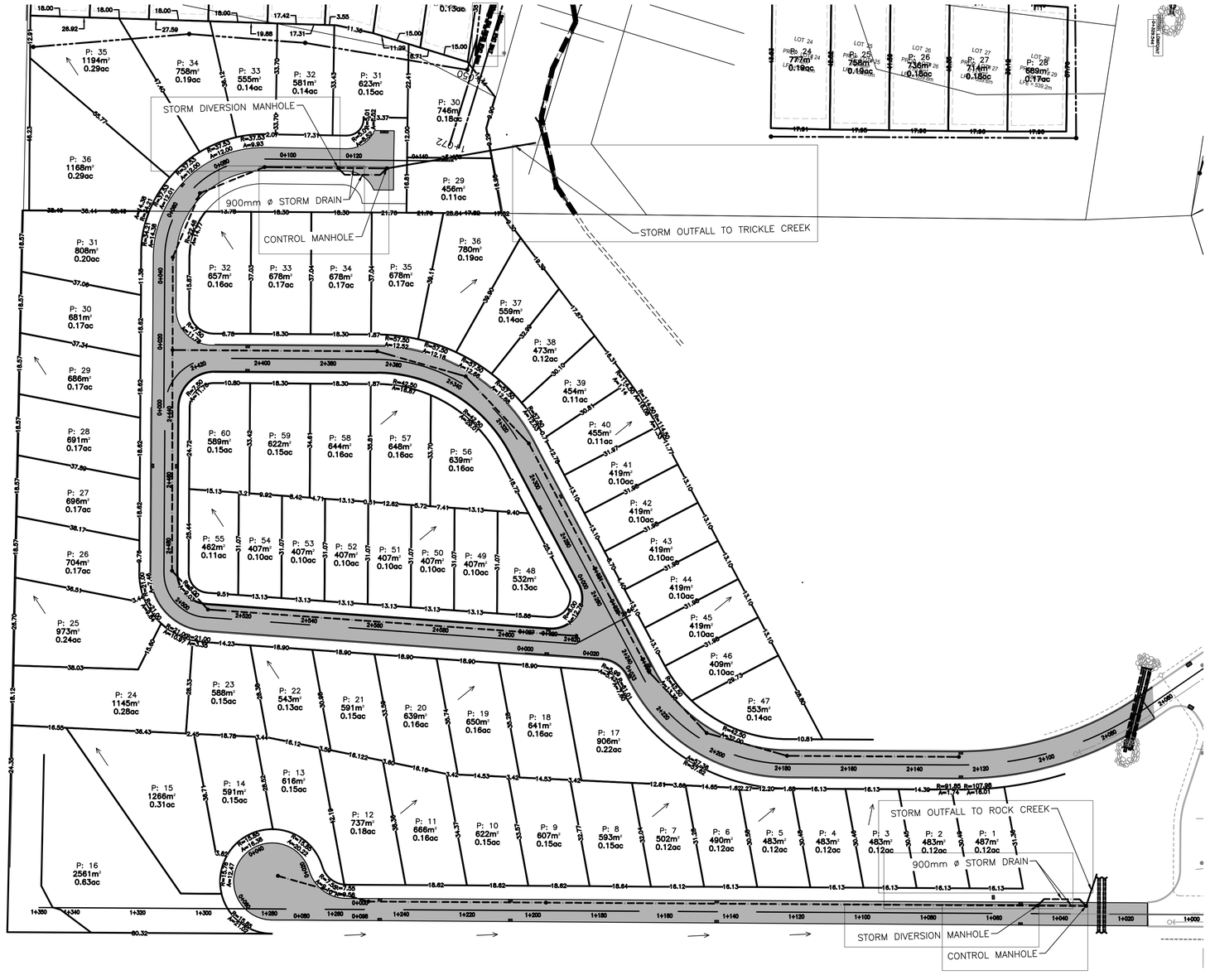
DRAWING NO.

ALPINE DRAWING NO.

DESIGN: DM CHECK: JA
DRAWN: DM APPR: JBK
ALPINE FILE:

DRAWING DATE:
FEBRUARY 2, 2022

SHEET NO. **C-2.0**
REV. **0**



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LEGAL DESCRIPTION: LOT 9, PLAN KAP72369, SECTION 7, TOWNSHIP 24, LAND DISTRICT 41 & AN UNDIVIDED 1/7 SHARE IN LOT 2

B.M. MONUMENT NO. ELEVATION:
LOCATED AT STREET & AVENUE

REV. NO.	DESCRIPTION	DR	CH	DATE	APP

ALPINE
CONSULTANTS LTD
1998 VERNON ST, LUMBY, BC V0E 2G0, CANADA
Tel: 250-870-6261, E-mail: general@alpineconsultants.ca
Permit to Practice: 1000176

CLIENT:
ACORN COMMUNITIES LTD.
3744 SEMINOLE ROAD, KELOWNA, BRITISH COLUMBIA, CANADA V1X 8G9
PH. 250-491-0095

PROJECT:
SUNSET RANCH STAGE 6: PROPOSED 60 LOT SUBDIVISION
3600 SUNSET RANCH DRIVE, KELOWNA, BRITISH COLUMBIA, CANADA V1X 8C7
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TITLE:
STORMWATER MANAGEMENT PLAN

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SCALE : HORZ. 1:500 VERT. –
ALPINE DRAWING NO.

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DRAWING DATE: **FEBRUARY 2, 2022**
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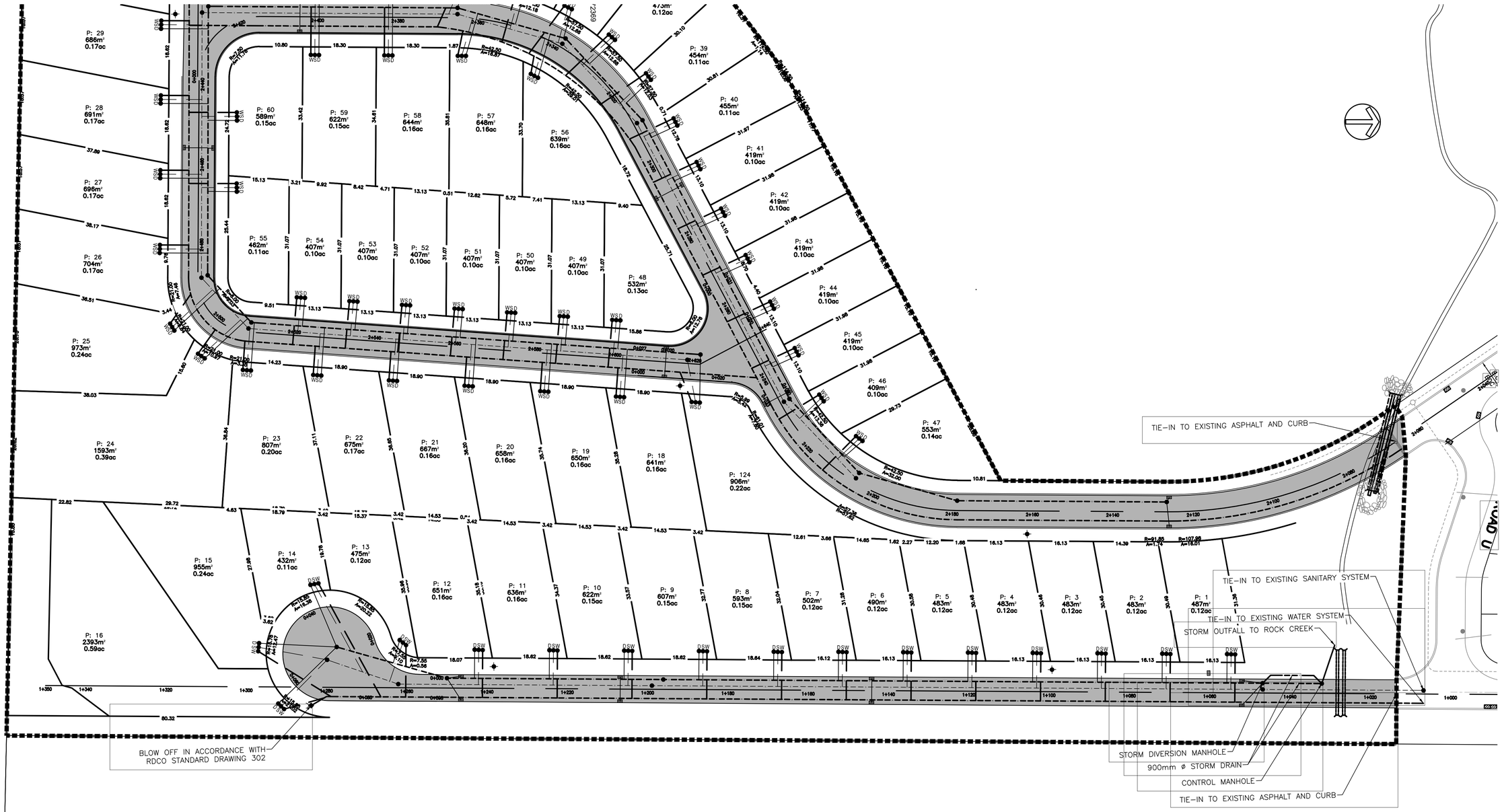

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LEGAL DESCRIPTION: LOT 9, PLAN KAP72369, SECTION 7, TOWNSHIP 24, LAND DISTRICT 41 & AN UNDIVIDED 1/7 SHARE IN LOT 2

B.M. MONUMENT NO. ELEVATION:
LOCATED AT STREET & AVENUE

REV. NO.	DESCRIPTION	DR	CH	DATE	APP

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1998 VERNON ST, LUMBY, BC V0E 2G0, CANADA
Tel: 250-870-6261, E-mail: general@alpineconsultants.ca
Permit to Practice: 1000176

CLIENT:
ACORN COMMUNITIES LTD.
3744 SEMINOLE ROAD, KELOWNA, BRITISH COLUMBIA, CANADA V1X 8G9
PH. 250-491-0095

PROJECT:
PHASE 6.0 EAST
3600 SUNSET RANCH DRIVE, KELOWNA, BRITISH COLUMBIA, CANADA V1X 8C7
PID: 025-561-529

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TITLE: **COMPOSITE UTILITY PLAN**

DESIGN: DM CHECK: JA
DRAWN: DM APPR.: JBK
ALPINE FILE:
PROJECT NO.
SCALE: HORZ. 1:500 VERT. –
DRAWING DATE: **JANUARY 28, 2022**
DRAWING NO.
ALPINE DRAWING NO.
SHEET NO. **C-5.0**
REV. **0**

NOTICE TO CONTRACTOR

IT IS THE RESPONSIBILITY OF THE CONTRACTOR'S SURVEYOR TO VERIFY THAT ALL LEGAL SURVEY DIMENSIONS SHOWN ON THE ENGINEERS DRAWINGS AGREE WITH THOSE ON THE REGISTERED LEGAL SURVEY PLAN. SHOULD THERE BE ANY DISCREPANCIES, THEN IMMEDIATELY NOTIFY THE ENGINEER OF RECORD

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B.M. MONUMENT NO. · ELEVATION: ·
LOCATED AT · STREET & · AVENUE

REV. NO.	DESCRIPTION	DR	CH	DATE	APP

ALPINE
CONSULTANTS LTD
1998 VERNON ST, LUMBY, BC V0E 2G0, CANADA
Tel: 250-870-6261, E-mail: general@alpineconsultants.ca
Permit to Practice: 1000176

CLIENT:
ACORN COMMUNITIES LTD.
3744 SEMINOLE ROAD, KELOWNA, BRITISH COLUMBIA, CANADA V1X 8G9
PH. 250-491-0095

PROJECT:
PHASE 6.0 WEST & PHASE 4.4
3600 SUNSET RANCH DRIVE, KELOWNA, BRITISH COLUMBIA, CANADA V1X 8C7
PID: 025-561-529

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TITLE:
COMPOSITE UTILITY PLAN

PROJECT NO.

SCALE :
HORZ. 1:500
VERT. –

DRAWING NO.

ALPINE DRAWING NO.

DESIGN: DM CHECK: JA
DRAWN: DM APPR: JBK

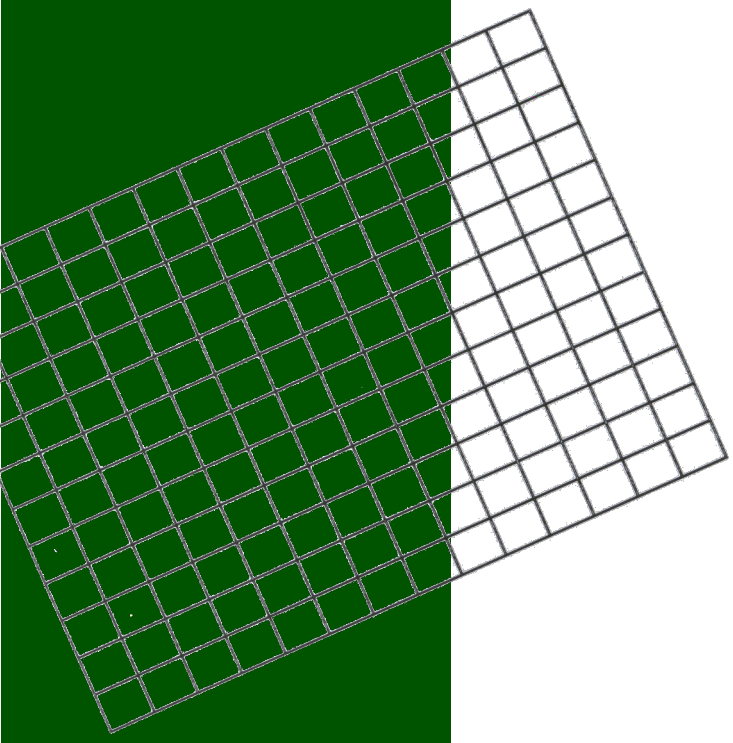
ALPINE FILE:

DRAWING DATE:
JANUARY 28, 2022

SHEET NO. **C-5.1**
REV. **0**

Appendix D

Phase 4.3 and 4.4 Servicing Brief Provided By Alpine Consultants Ltd.



SERVICING BRIEF

SUNSET RANCH
PHASES 4.3 & 4.4
Proposed 36-Lot Subdivision
Trickle Creek Drive, Kelowna

For Review by:

Sunset Two Properties Ltd.

Submitted by:

Alpine Consultants Ltd.

1998 Vernon Street
Lumby, BC V0E 2G0
Ph: 250-870-6261
Permit to Practice: 1000176
James B. Kay, P.Eng
JKay@AlpineConsultants.ca

Alpine Project No: 2021-085
February 6, 2022

February 6, 2022

ALPINE
Consultants Ltd.

Sunset Two Properties
3744 Seminole Road
Kelowna BC V1W 4B4

Alpine Project No:2021-085
Permit to Practice: 1000176

Attention: **Mr. Greg Bird**
President

Dear Sirs:

Re: **Servicing Brief**
Sunset Ranch Phases 4.3 & 4.4
Proposed 36-Lot Residential Subdivision

Alpine Consultants Ltd. is pleased to provide this servicing brief in support of the proposed thirty-six (36) lot residential subdivision. This brief outlines the proposed servicing strategy and adequacy of existing infrastructure to support a residential development, part of an overall master-planned community, at Sunset Ranch in Kelowna, BC.

Sunset Phase 4.3 is proposed as a mix of Duplex and Single-family homes totalling 36 units, connecting to utility services planned and installed in previous development phases in Trickle Creek Drive. The services had therefore been anticipated and calculations undertaken in the overall planning. This servicing brief will complement the existing planning documentation and confirm the capacity of the existing and proposed infrastructure.

Please feel free to contact me should you require any additional information or clarification. We will make ourselves available at your convenience should you wish to get together to discuss the brief further. Otherwise, we thank you for this opportunity to complete this Servicing Brief and we look forward to working with you as this project progresses

Yours truly,
ALPINE CONSULTANTS LTD.

James Kay

Jason Angus
Project Coordinator/Design Technologist

James Kay, P.Eng
Principal/Project Manager

CC: Mr. Michael Noga, RDCO

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This Servicing Brief addresses the road, water, sanitary and storm infrastructure, lot grading, storm water management, and shallow utilities associated with the proposed development.

1.1 BACKGROUND

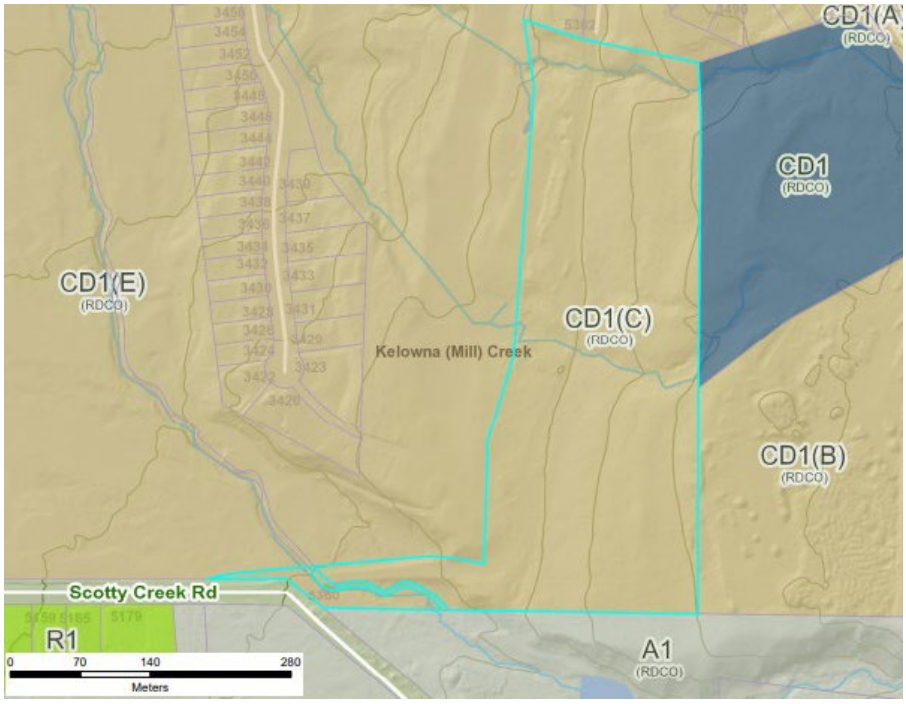
Alpine Consultants Ltd. has been engaged by our client, Sunset Two Properties Ltd, to develop a thirty-six (36) lot residential development complete with engineering design and support.

1.2 SITE DESCRIPTION

The Property is zoned CD1(C) and measures 11.86 acres. The site is currently an undeveloped area with one home and an associated garage, gravel surfaced road though the center, and two creeks that cross, Rockface Creek, and a tributary to Rockface Creek. Utilities have been constructed to the north property line in previous phases. As-builts have been provided to show the locations of the utilities.

1.3 DEVELOPMENT CONCEPT

It is proposed to develop the residential development as an extension to the previous phase on Trickle Creek Drive. Servicing the new development will be an extension to the utilities at the south end of trickle drive.



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This servicing brief has analyzed the existing and adjacent infrastructure for suitability of servicing the next phase of development along Trickle Creek Drive. We have investigated and located the existing offsite infrastructure using area maps as-built drawings, and survey. We have reviewed existing bylaws and studies to establish the required levels of service and constraints. We have compiled and reviewed all available, relevant information to try to identify any constraints in the existing and proposed infrastructure.

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Review of this Bylaw establishes minimum levels of service and performance of the engineering infrastructure in public rights-of-way. By no means is this intended to be a comprehensive synopsis of this extensive document, however, it provides valuable information as to whether the existing infrastructure may be suitable to service the proposed development.

Highlights of the Bylaw include the following:

Water

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  - *Average day demand: 900 l/capita/day*
  - *Maximum Day demand: 2100 l/capita/day*
  - *Peak hour demand: 3600 l/capita/day*

- *Fire Flows*
    - *Residential: 60l/s*

At the south end of Trickle Creek Drive, there is an existing 200mm water main that can be utilized to extend into the next phase of development.

Sanitary

- *Domestic Flow Rate: 300l/capita/day*
- *Infiltration rates: 5000l/ha/day*
- *Design Capita: 36 units x 3 people/unit = 108 people*
- *Peaking Factor is calculated by using the Harmon Equation*
- *Pipes sizes must be selected so that the sewers flow 2/3 to 3/4 full at peak hour design flow.*
- *Minimum Velocity: 0.6m/s*

At the south end of Trickle Drive, there is an existing 200mm sanitary sewer main that can be utilized to extend into the next phase of development. The sanitary main along Trickle Creek Drive will service not only Phase 4.3 and 4.4, but also the future phases 6.1, 6.2 and 6.3 on the hillside above Phase 4.4.

Storm Drainage

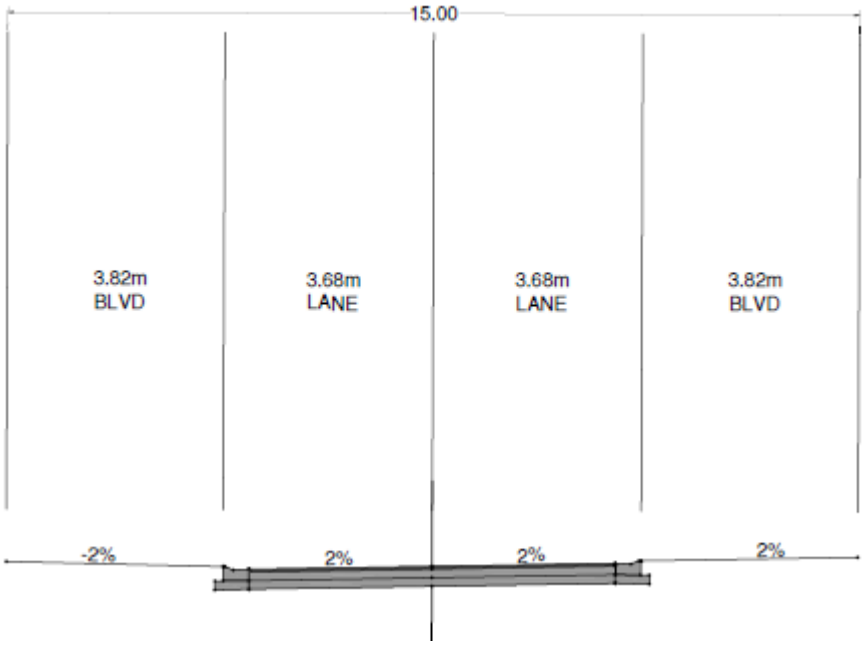
- *Rational Method acceptable for small watersheds (10ha or less)*
- *Minor Drainage System designed for 5-year return frequency*
- *Major Drainage System designed for 100-year return frequency*
- *Stormwater management systems must incorporate such techniques as lot grading, surface infiltration, and sub-surface disposal, storage, or other acceptable methods to limit the peak run-off from the development (100-yr) to pre-development flows (5yr)*

As offsite improvements Alpine Consultants are proposing the construction of rock pits for the west side properties of Trickle Creek Drive and underground storage tanks to control the drainage runoff. This storm network is proposed to function as a standalone piece of infrastructure but will also allow for upstream and downstream connection should future development require.

A detailed SWMP Brief will accompany the detailed civil engineering submission.

Roads

Trickle Creek Drive is already existing from a previous phase. Phase 4.3 will see the extension of Trickle Creek Drive to the south. This will be a newly constructed road complete with curb gutter and storm drainage system. Driveway access will be constructed to each residential unit.



Phase 4.3 is designed for residential containing 28 units, and therefore is expected to have a minimal impact to the surrounding transportation network. Additionally once phase 4.3 is constructed there will be no more future phases south of this phase. Phase 4.4 is designed for residential containing 8 units, and will connect east through Stage 6.1.

3.0 ENGINEERING INFRASTRUCTURE ANALYSIS

As noted, this servicing brief has analyzed the existing and adjacent infrastructure for suitability of servicing the next phase of Sunset Ranch. The detailed set of drawings will be provided further information in support of phases 4.3 and 4.4 of the subdivision. The following is to provide a level of detail as appropriate.

3.1 WATER SYSTEMS DEMAND

Based on the Subdivision & Development Servicing Bylaw information in section 2.1, it is expected that fire flows of 60L/s will be required, and that based on the mechanical fixture unit calculations it is approximated the next phase of trickle Creek will require the flows of:

- Average Daily Demand = 108 People x 900 L/c/d/ (24x60x60) = 1.13 L/s
- Maximum Day Demand = 108 people x 2100L/c/d/ (24x60x60) = 2.63L/s
- Peak Hour Demand = 108 people x 3600L/c/d/ (24x60x60) = 4.5L/s
- Fire Flow = 60L/s

It is proposed to provide a 200mm PVC watermain, connecting to the existing watermain in Trickle Creek Drive and extending to the south for the next phase of the subdivision. Fire hydrants will be provided along the new Trickle Creek Drive to provide the required coverage.

3.2 SANITARY SEWER SYSTEM DEMAND

Based on the Subdivision & Development Servicing Bylaw information in section 2.1, the 1.436 Ha phase of trickle creek will generate flows of:

- Average Daily Flow = 108 people x 300L/c/d/ (24x60x60) = 0.375L/s
- Infiltration Flow = 1.436Ha x 5000L/Ha/d/ (24x60x60) = 0.83L/s
- Peaking Factor = 75% x 1+14/(4+√P) = 0.75x(1+14/ (4+√ (108/1000)) = 3.2
- Peak Flows = 0.375L/s x 3.2 = 1.2L/s + 0.83L/s = 2.03 L/s

It is proposed to provide a 200mm PVC sanitary sewer main, connecting to the existing sanitary sewer main in Trickle Creek Drive and extend to the south for the next phase of subdivision. Future phases on the hillside above to the east will also be serviced by this sanitary sewer main. Future phase will see a design population of 180 people over 5.5Ha. Using the above rational, this would lead to a potential total flow to the Trickle Creek Drive sanitary sewer of approximately 4.2L/s at peak times.

3.3 STORM DRAINAGE CAPACITY & STORM WATER MANAGEMENT

Alpine Consultants will utilize a wide range of Best Management Practices pertaining to the storm water management. These will focus on the three areas of practice: peak flow attenuation, volume reduction, and storm water quality. It is proposed that the storm management system should include:

- Lot level retention and detention on the site through rock pits, underground chambers, etc. A downstream detention facility will be considered. Some of these systems will either be owned by property owners or the RDCO.

Alpine Consultants will provide an overall storm runoff strategy under separate cover. In summary the required storm storage for the initial Phase is approximately 185 cubic meters and will be provided in a combination of rock pits, perforated pipes and underground chambers with outflow being limited to Rockface Creek.

3.4 SHALLOW UTILITIES

There are known underground utilities with the existing phase of Trickle Creek. These utilities will be extended into the new phase. All servicing to the new phase and the proposed properties will be underground as per requirements. This shall include but not limited to:

- Electrical
- Telephone
- Cable TV
- Gas

4.0 CONCLUSIONS, RECOMMENDATIONS AND FURTHER STUDY

Alpine Consultants Ltd. have taken a comprehensive review of the proposed phase 4.3 & 4.4 of Sunset Ranch as well as the pertaining information to the existing infrastructure and down stream capacities. In Alpine Consultants' opinion, there are no capacity restraints that would prohibit the next phase of the development.

4.1 DEVELOPMENT PROCESS

From an engineering perspective, the Phases 4.3 and 4.4 of this site could proceed on the aforementioned basis, providing infrastructure and services to future development lands, without hindering future decisions.

4.2 GEOTECHNICAL ASSESSMENT

A geotechnical assessment has been completed. Design & construction works are proposed in accordance with the geotechnical assessment.

4.3 CONCLUSION

Review and assessment of the existing Water, Sanitary, Storm, and Road infrastructure indicates that the proposed Phases 4.3 & 4.4 of Sunset Ranch can be supported with extensions of the existing utilities. As such, from an engineering and servicing infrastructure perspective, the there are no technical constraints that would preclude or prevent these phases from proceeding.

Yours truly,

ALPINE CIVIL ENGINEERING CONSULTANTS LTD.

James Kay

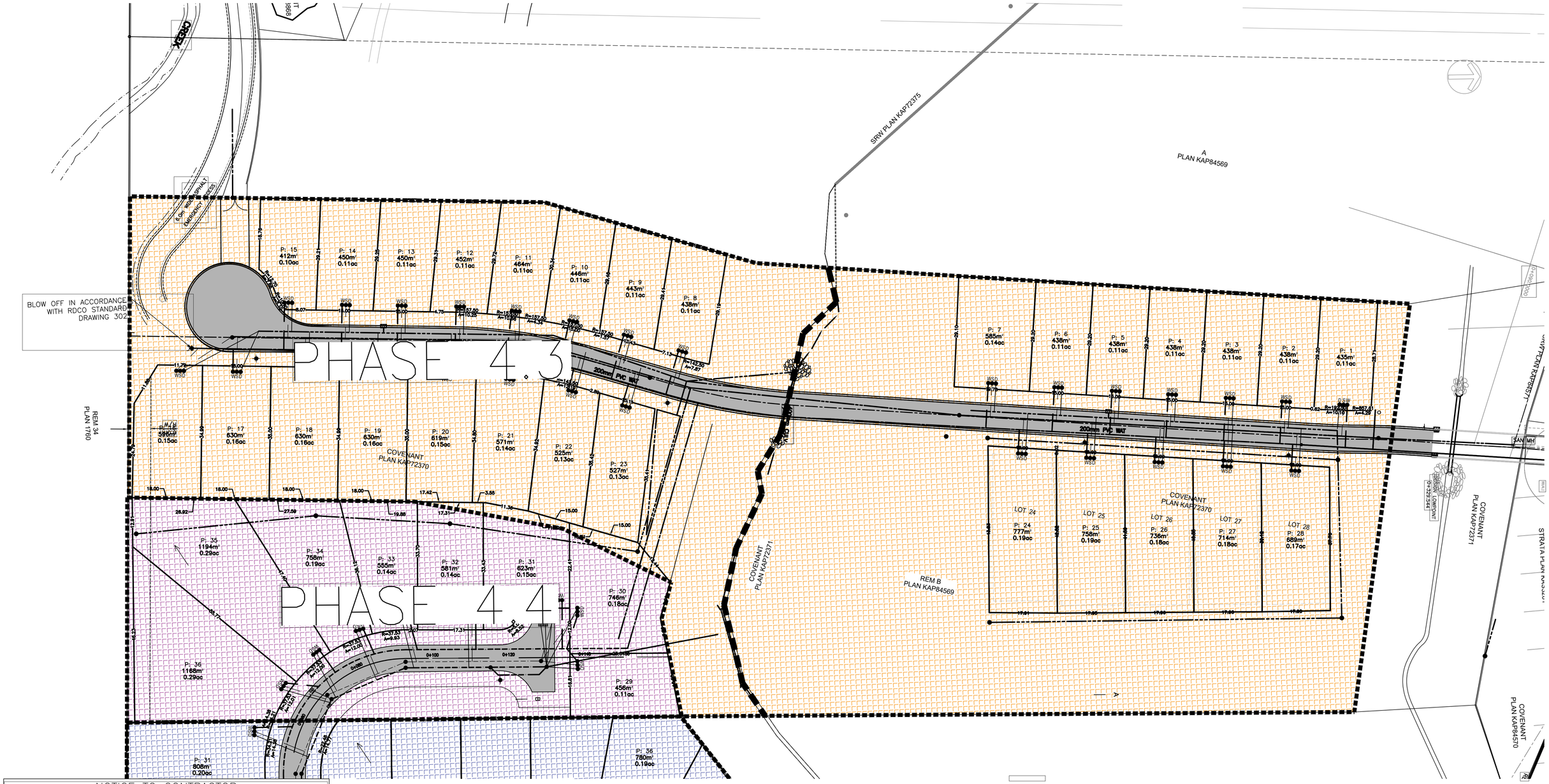
Jason Angus
Project Coordinator/Design Technologist

James B. Kay, P.Eng.
Principal

CC: Mr. Michael Noga, RDCO

APPENDIX I

INFRASTRUCTURE DRAWINGS



NOTICE TO CONTRACTOR

IT IS THE RESPONSIBILITY OF THE CONTRACTOR'S SURVEYOR TO VERIFY THAT ALL LEGAL SURVEY DIMENSIONS SHOWN ON THE ENGINEERS DRAWINGS AGREE WITH THOSE ON THE REGISTERED LEGAL SURVEY PLAN. SHOULD THERE BE ANY DISCREPANCIES, THEN IMMEDIATELY NOTIFY THE ENGINEER OF RECORD

LEGAL DESCRIPTION: LOT B PLAN KAP84569 SECTION 7 TOWNSHIP 24
LAND DISTRICT 41 EXCEPT PLAN KAS3281

B.M. MONUMENT NO. ELEVATION:
LOCATED AT STREET & AVENUE

REV. NO.	DESCRIPTION	DR	CH	DATE	APP

ALPINE
CONSULTANTS LTD
1998 VERNON ST, LUMBY, BC V0E 2G0, CANADA
Tel: 250-870-6261, E-mail: general@alpineconsultants.ca
Permit to Practice: 1000176

CLIENT:
ACORN COMMUNITIES LTD.
3744 SEMINOLE ROAD, KELOWNA, BRITISH COLUMBIA, CANADA V1X 8G9
PH. 250-491-0095

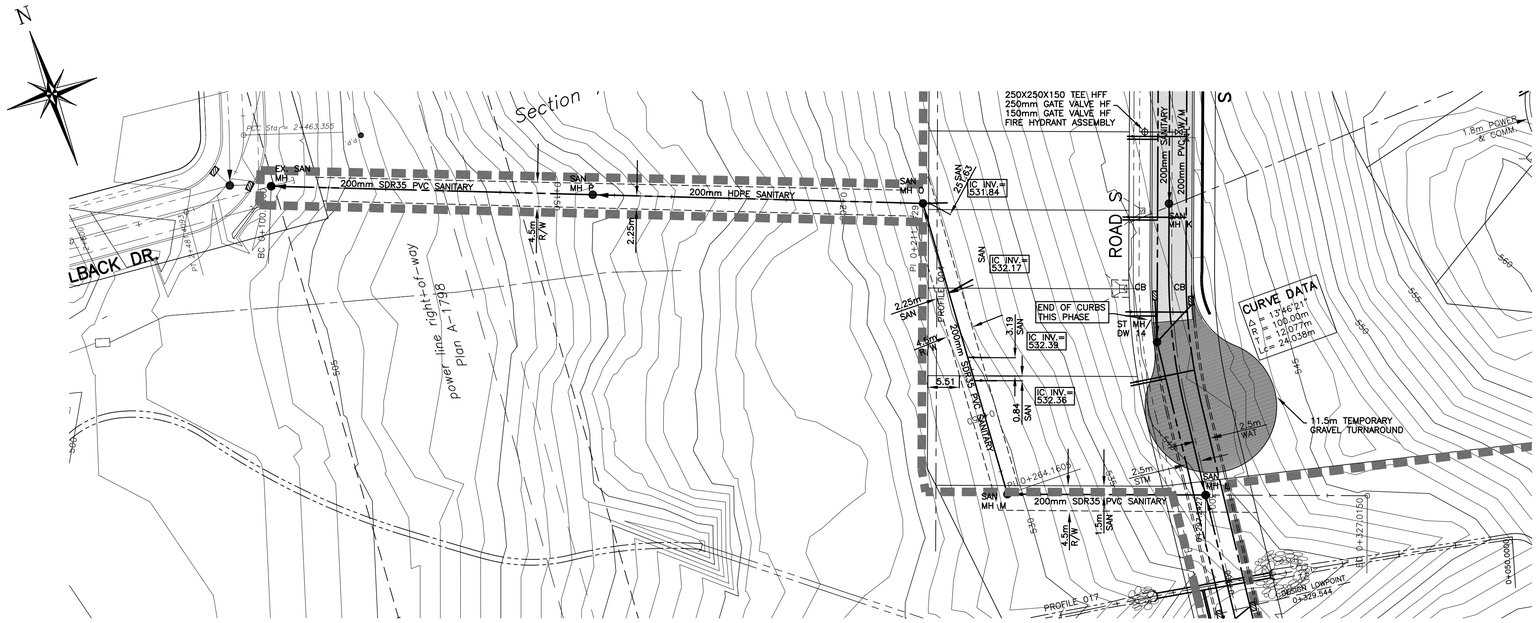
PROJECT:
SUNSET RANCH STAGE 4.3 & 4.4: PROPOSED 36 LOT SUBDIVISION
5300 TRICKLE CREEK DRIVE, KELOWNA, BRITISH COLUMBIA, CANADA V1X 8C7
PID: 027-168-158

The location of existing underground utilities are shown in an approximate way only & have not been independently verified by the owner or its representative. The contractor shall determine the exact location of all existing utilities before commencing work, and agrees to be fully responsible for any and all damages which might be occasioned by the contractor's failure to exactly locate and preserve any and all underground utilities.

TITLE:
PHASING PLAN

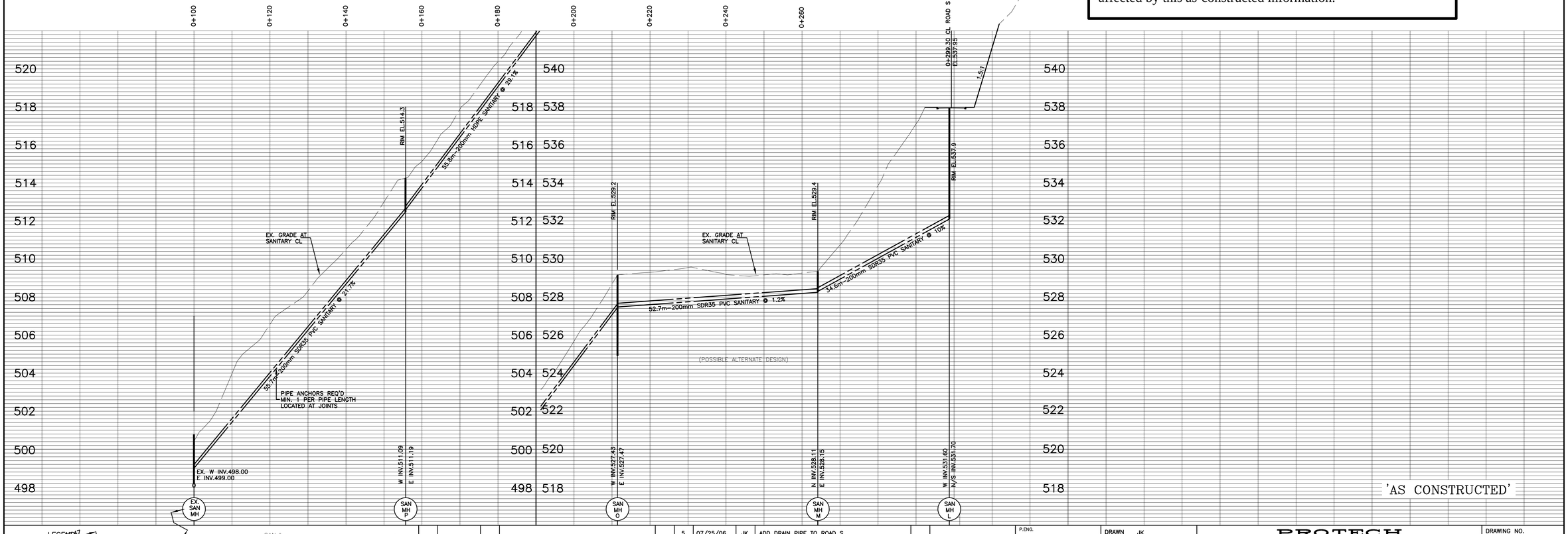
PROJECT NO.
SCALE :
HORZ. 1:500
VERT. –
DRAWING NO.
ALPINE DRAWING NO.

DESIGN: DM CHECK: JA
DRAWN: DM APPR: JBK
ALPINE FILE:
DRAWING DATE:
FEBRUARY 2, 2022
SHEET NO. C-2.0
REV. 0



NOTE: PIPE ANCHORS ARE ON ALL PIPES INSTALLED AT GRADES GREATER THAN 15% AS PER THE MASTER MUNICIPAL CONTRACT DOCUMENT DRAWING G8

"This as-constructed information was not prepared by the Regional District of Central Okanagan and therefore there is no guarantee of its accuracy. It is the recipient's and user's responsibility to confirm the accuracy of this as-constructed information before proceeding with any work that may be affected by this as-constructed information."



'AS CONSTRUCTED'

LEGEND

CABLE TV	CAP
GAS	CATCH BASIN
SAN. SEWER	ELECTRICAL BOX
STORM SEWER	HYDRANT
U.G. ELECTRICAL	VALVE
U.G. TELEPHONE	LAMP STANDARD
WATER	

SAN #	SANITARY MH (EXISTING OR FUTURE)
SAN #	SANITARY MH (PROPOSED)
STM #	STORM MH (EXISTING OR FUTURE)
STM #	STORM MH (PROPOSED)
	TRANSFORMER
	UTILITY JUNCTION BOX

No.	MM/DD/YY DATE	BY	REVISION	Chk'd
8	04/23/07	CWL	AS CONSTRUCTED	
7	10/16/06	JK	REVISE SANITARY ALIGNMENT & GRADE	
6	07/28/06	JK	REMOVE DRAIN PIPE	
5	07/25/06	JK	ADD DRAIN PIPE TO ROAD S	
4	04/18/06	JK	REVISE WATER	
3	04/10/06	JK	ADD ELECTRICAL, COMMUNICATIONS & GAS	
2	03/27/06	JK	REVISE ROAD GRADE & PIPE INVERTS	
1	03/14/06	db	ADDED NOTE RE: PIPE ANCHORS	

REGIONAL DISTRICT of CENTRAL OKANAGAN

P.ENG.

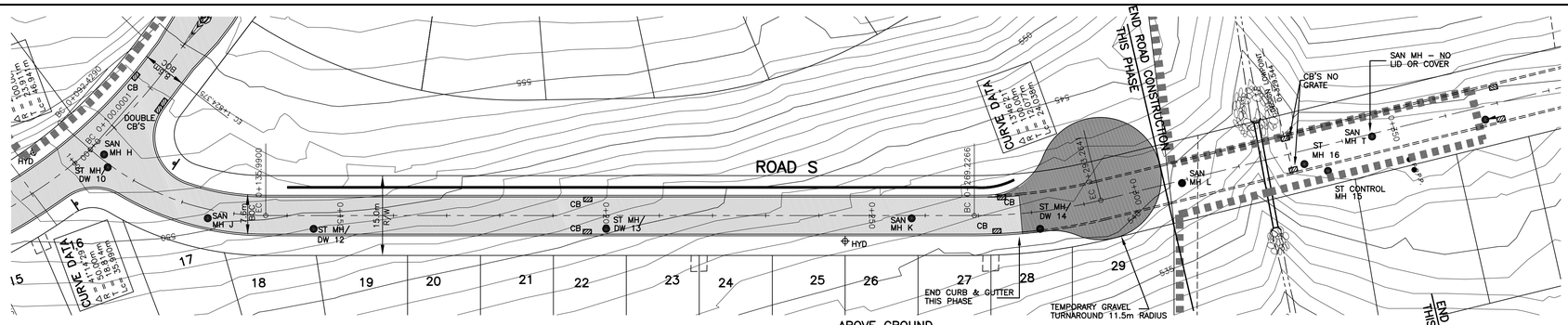
DRAWN	JK
DESIGN	DLB
CHECKED	MDY
DATE	DECEMBER 05
SCALE	HORIZ 1:500 VERT 1:100

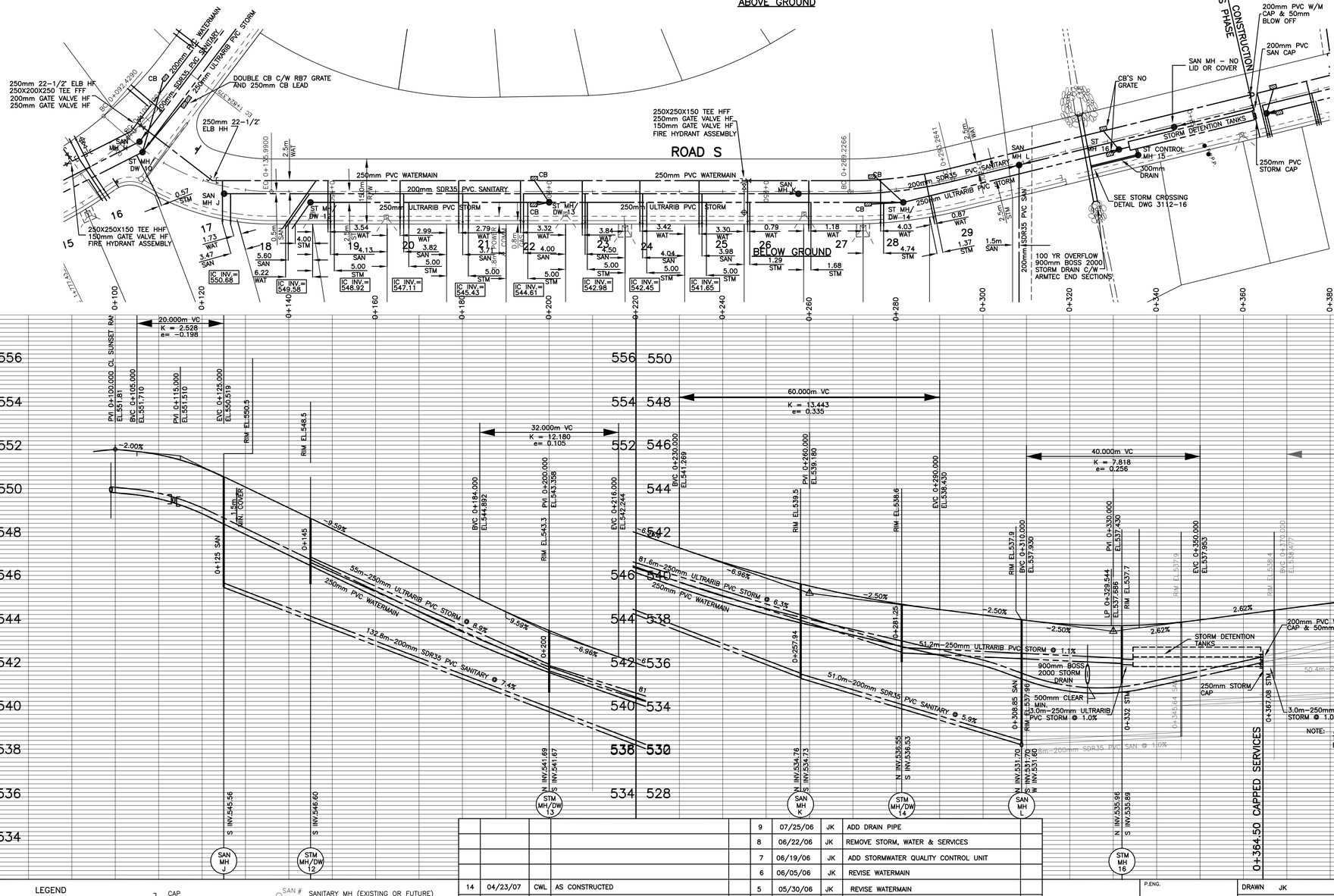
PROTECH CONSULTANTS LTD.
Phone 860-1771 FAX 860-1994

SUNSET RANCH-STAGE 4 PHASE I SANITARY ALIGNMENT TO STAGE 3 SANITARY DESIGN

DRAWING NO. 3112-15

REV. NO. 8





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LEGEND

CABLE TV	CAP	SAN #	SANITARY MH (EXISTING OR FUTURE)
GAS	CATCH BASIN	SAN #	SANITARY MH (PROPOSED)
SAN. SEWER	ELECTRICAL BOX	STM #	STORM MH (EXISTING OR FUTURE)
STORM SEWER	HYDRANT	STM #	STORM MH (PROPOSED)
U.G. ELECTRICAL	VALVE		TRANSFORMER
U.G. TELEPHONE	LAMP STANDARD		UTILITY JUNCTION BOX
WATER			

No.	DATE	BY	REVISION	Chk'd
14	04/23/07	CWL	AS CONSTRUCTED	
13	02/20/07	JK	REVISE CB'S & STORM DETENTION	
12	01/04//07	JK	REVISE STORM & DETENTION AREA	
11	11/03/06	JK	REVISE ROAD PROFILE, CB, FUTURE SAN & WATER	
10	07/28/06	JK	REMOVE DRAIN PIPE	
9	07/25/06	JK	ADD DRAIN PIPE	
8	06/22/06	JK	REMOVE STORM, WATER & SERVICES	
7	06/19/06	JK	ADD STORMWATER QUALITY CONTROL UNIT	
6	06/05/06	JK	REVISE WATERMAIN	
5	05/30/06	JK	REVISE WATERMAIN	
4	04/21/06	JK	REVISE WATER & ADD SAN MH T	
3	04/18/06	JK	REVISE WATER	
2	04/10/06	JK	ADD ELEC, COMMUNICATIONS & GAS	
1	03/27/06	JK	REVISE ROAD GRADES, SERVICING ETC.	

REGIONAL DISTRICT of CENTRAL OKANAGAN

P.ENG.

'AS CONSTRUCTED'

DRAWN	JK
DESIGN	DLB
CHECKED	MDY
DATE	DECEMBER 05
SCALE	HORIZ 1:500 VERT 1:100

PROTECH CONSULTANTS LTD.
Phone 860–1771 200 – 1449 St. Paul Street Kelowna, B.C. FAX 860–1994

SUNSET RANCH–STAGE 4 PHASE I
ROAD S 0+100 TO 0+430
ROAD AND UTILITIES

DRAWING NO. 3112–13

REV. NO. 14

GREEN SPACE AND ACCESS TO EMERGENCY ROUTE

TO BE REMOVED

ROCKPITS

CONTROL MH

CONTROLLED DISCHARGE TO CREEK AT PREDEVELOPMENT FLOWS ORIFICE SIZED AT 150mm DIAMETER

BUILDING TO BE DEMOLISHED PRIOR TO CONSTRUCTION

ROCKPITS

LOCATE STUB AND CONNECT TO EXISTING DETENTION TANKS DISCHARGE TO PREDEVELOPMENT FLOWS

LOCATE AND CONNECT TO EXISTING SANITARY MAIN

CONNECT TO EXISTING WATERMAIN

STORM TANK AREA: 78m

Remove and Replace Existing 400mm culvert with twin 600mm-diameter culverts from Sunset Ranch Drive.

TO BE REMOVED

TO BE REMOVED

TO BE REMOVED

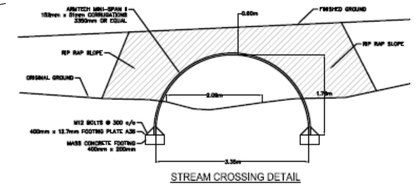
FRENCH DRAIN

ROCK STACK WALL ALONG 2:1 CUT ON UPPER BOUNDARY

CLEANOUT MH

STORM TANK AREA: 78m

REMOVE AND REPLACE EXISTING CULVERT WITH ARMTECH MINI SPAN II STEEL ARCH SIMILAR TO THE TYPICAL DETAIL BELOW. DETAILED DESIGN TO BE TO THE SATISFACTION OF MoTI AND RDCO



STREAM CROSSING DETAIL

NOTICE TO CONTRACTOR

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LEGAL DESCRIPTION: LOT B PLAN KAP84569 SECTION 7 TOWNSHIP 24 LAND DISTRICT 41 EXCEPT PLAN KAS3281

B.M. MONUMENT NO. ELEVATION:

LOCATED AT STREET & AVENUE

REV. NO.	DESCRIPTION	DR	CH	DATE	APP

ALPINE CONSULTANTS LTD

1998 VERNON ST, LUMBY, BC V0E 2G0, CANADA

Tel: 250-870-6261, E-mail: general@alpineconsultants.ca

CLIENT:

ACORN COMMUNITIES LTD.

3744 SEMINOLE ROAD, KELOWNA, BRITISH COLUMBIA, CANADA V1X 8G9

PH. 250-491-0095

PROJECT:

PHASE 4.3

5101 UPPER BOOTH ROAD, KELOWNA, BRITISH COLUMBIA, CANADA V1X 7V8

PID: 027-168-158

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TITLE:

COMPOSITE UTILITY PLAN

PROJECT NO.

SCALE : HORZ. 1:500 VERT. –

DRAWING NO.

ALPINE DRAWING NO.

DESIGN: DM CHECK: JA

DRAWN: DM APPR: JBK

ALPINE FILE: 2021–085

DRAWING DATE: **JANUARY 11, 2022**

SHEET NO. **C-001**

REV. **0**

Appendix E

Site Photos

Photo 1. View of Rockface Creek looking north.

Photo 2. View of Rockface tributary looking west towards proposed Trickle Creek Road crossing and associated culvert replacements.

Photo 3. View of CD ecosystem associated with Polygon 7.

Photo 4. View of proposed upgrade to arch culvert at Sunset Ranch Drive over Rockface Creek.

Photo 5. View of road associated with proposed upgrade to arch culvert at Sunset Ranch Drive over Rockface Creek, looking south.