SONOMA MOUNTAIN VILLAGE

Water Plan

October 9, 2006

Sonoma Green L.L.C. & K.D.R.P. L.L.C. respectfully submits this draft plan for water use, conservation and protection at Sonoma Mountain Village.[1] With this report, we attempt to identify known concerns and articulate our vision for sustainable development. The details of implementing this plan will be worked out during the EIR process and beyond, and with significant input from all stakeholders.

[1] Contributors to this report include Ed Ballman, John Stamm and Barry Hecht of Balance Hydrologics in Berkeley, Sierra Hart of Allen Land Design in Santa Rosa, Greg Hurd of Carlenzoli & Associates in Santa Rosa, Lois Fisher and Laura Hall of Fisher & Hall in Santa Rosa, and David LaVelle and Christopher Mills of BKF in Walnut Creek.

Reader's Guide to Acronyms

AFY	Acre-Feet per Year. 1 AFY = 325,851 gallons.
EIR	Environmental Impact Report
ET, ETo	Evapotranspiration (water that evaporates from plants and soil)
gpf, gpm	gallons per flush (e.g. for toilets) and gallons per minute (e.g., for faucets)
HOA	Homeowner's Association
LAFCO	Local Agency Formation Commission (county organization responsible for overseeing the formation of special districts)
NPDES	National Pollution Discharge Elimination System
SCWA	Sonoma County Water Agency
SWMP	Stormwater Management Plan
SWPPP	Stormwater Pollution Prevention Plan
WUCOLS	Water Use Classifications of Landscape Species

Russian River near Duncan's Mills Photo by Finlay McWalter

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The Business of Stewardship

A Letter From the Chief Sustainability Officer

Sonoma Mountain Village represents a very different kind of project than we at Codding Enterprises have built in the past, and this change needs some explanation.

Increasing land prices and stricter limits to growth have forced us to rethink our business model. We are aware of the growing interest in green buildings and have become more educated about a wide range of environmental crises, from drought-year water planning in California to global warming.

When we compare our past business model with one that embraces environmental stewardship, we discover that sustainable practices have a solid and growing future while standard development requires ever-increasing effort for declining profits.

This plan is our first attempt to define what we mean by our newfound focus on sustainability as it relates to water. Over time, it will be refined from our own research as well as from feedback by members of the community, environmental groups and local government agencies. We welcome this feedback and I personally invite everyone who can help us successfully steward natural resources to contact me at 707-795-3550.

Geof Syphers, PE, LEED™ AP
Chief Sustainability Officer

A Different Future

Over the next twenty years, California will add 10 million new residents and, with that, impacts and stress from growth will become more pronounced. Local concerns include increased water and energy demands, traffic congestion and pollution. Just a few of the global concerns include climate change, sea-level rise, and the decline of easy-to-extract fossil fuels.

While we are blessed with a moderate climate and we do not have the same flooding concerns of a low-lying coastal city, we still feel the need to address these concerns. The walkable, water-conserving and energy-efficient design of Sonoma Mountain Village will thrive in the future. Specific goals of the project include such diverse proposals as:

- Minimizing summer solar gain while still taking advantage of daylighting
- Reducing our dependence on cars and particularly on fossil fuels through planning mixed-use buildings and neighborhoods and encouraging biofuels and mass transit
- A carbon-neutral jobsite with biodiesel trucks and equipment and the re-use of nearly all construction debris on site

However, the goal of this document is to identify the strategies and approaches that we intend to implement at Sonoma Mountain Village with respect to water resources conservation. Perhaps most simply stated, our intent is to fundamentally understand and work with both natural and human-driven hydrologic cycles in a manner that sets new standards for efficiency and sustainability.

Figure 1. The Site of Sonoma Mountain Village

The Hydrologic Cycle

The hydrologic cycle will provide the framework for understanding the many dimensions of water use at Sonoma Mountain Village (Figure 2). The local hydrologic cycle describes the pathways of water as it both enters and exits the site. For example, water enters the site as precipitation, surface water (run-on), groundwater flow and applied irrigation water. Water naturally exits the site via evaporation (from soils, ditches and wetlands), plant transpiration, surface runoff, and groundwater flow. During parts of the year, water can be stored in soils. By identifying the importance of each of the components we can define the true water budget and natural and man-made consumptive uses at the site. Here, the term ‘consumptive use’ describes those pathways in the cycle that remove water from the local watershed and groundwater system.

Linking the regional controls on the water budget (geology, soils, land-use and runoff changes) provides an understanding of the sustainability of Sonoma Mountain Village in the context of the sensitivity of the system to external changes. This provides a guideline from which to design a water system that sustains the local hydrologic cycle, mitigates consumptive uses in Sonoma Mountain Village, and absorbs impacts from external changes to the hydrologic cycle (such as from changes in land-use of surrounding areas). Practices that may be considered consumptive in traditional developments can be redesigned to allow for reuse, natural filtration, and the return of water to the natural hydrologic cycle. Questions regarding infiltration and local recharge can be resolved by site studies (mapping, soil descriptions, gaging of local runoff). Controls on groundwater flow can be further resolved by analysis of subsurface geology as described in local well logs.

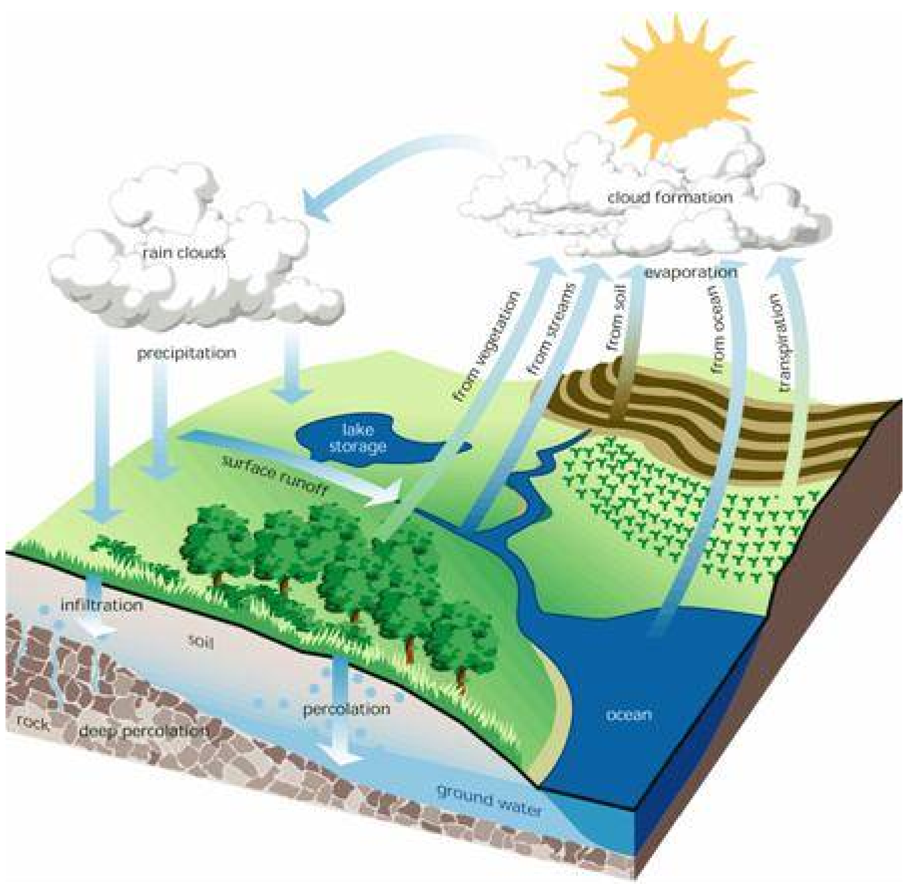

Figure 2. Conceptual Illustration of the Hydrological Cycle

The local climate is characterized by a relatively high average rainfall, with the long-term record from Santa Rosa (Station 047965) showing an average of 30.1 inches per year. However, any sustainable hydrologic system must anticipate the large variability in precipitation, which has ranged from a high of 55.7 inches in Water Year 1983 to a low of 12.8 inches in the severe drought of Water Year 1976. This precipitation pattern is the primary driver for the overall hydrologic cycle and we are actively studying how it influences rates of surface runoff and groundwater recharge at the site.

Known Concerns

We are aware of the following concerns relating to water use and water quality at Sonoma Mountain Village.

1. Concerns relating to increased water supply usage
   a. Depletion of groundwater due to wells on site and generally throughout the Santa Rosa Valley basin
   b. Ecological and infrastructure costs related to increased water demand from the Russian River
   c. Political costs of scarce water development rights

2. Concerns relating to increased sewage volumes
   a. Capacity limits of existing wastewater pipes and treatment facilities
   b. Cost of infrastructure enhancements

3. Concerns related to transformation of the land use
   a. Elevated flood risk from increased site imperviousness
   b. Depletion of groundwater due to loss of natural recharge
   c. Hydromodification – the alteration of stream flow regimes leading to impacts such as bank erosion, channel downcutting, and changes in sediment transport

4. Concerns relating to water quality
   a. Construction activity erosion, sedimentation and contamination
   b. Need for a comprehensive stormwater quality program utilizing a suite of proven best management practices
   c. Stress or damage to Lichau and Cotati Creeks and the larger Petaluma River and Laguna de Santa Rosa/Russian River systems
   d. Stress or damage to Tiger Salamander habitat
   e. Stress or damage to wetlands both on site and neighboring sites

We have begun to think about how we might address each of these concerns, but the real analysis will occur during the environmental impact study process. We understand that additional concerns will emerge as the project progresses and we are committed to addressing them in an open and thorough manner as well.

Compatibility with Local and Regional Planning Objectives

Especially in connection with water, design of a new community can usefully begin by asking, "How can this project best meet the goals and values sought for flows onto and off of the site?" While this question may lead to answers from literally dozens of plans and codes, some of the key plans that may shape Sonoma Mountain Village from its inception are described below.

Regional Guidelines: The Water Quality Control Boards

The Basin Plans issued by the North Coast (Region 1) and San Francisco Bay Region (Region 2) of the California Regional Water Quality Control Boards. Both Boards have extensive and articulated programs designed to protect both surface and ground waters, with present emphasis on storm-water management. At a site-specific level, measures reducing the volumes of runoff and using detailed best-management practices adapted to conditions in Sonoma County will be required for conformance with Board programs and guidelines, as well as to meet or exceed the practices under design elsewhere in Sonoma County.

The boundary between the two regions bisects Sonoma Mountain Village. Both regions seek from the project protection of the numerous beneficial uses designated for the Laguna de Santa Rosa (Region 1) and Lichau Creeks (Region 2).

Additionally, Region 2 calls for particular attention to be placed on protecting channels downstream of a project from bank erosion or scour which may be caused by effects of urbanization on runoff.

Laguna de Santa Rosa

The northern half of the site drains into the headwaters of the Laguna de Santa Rosa, a unique and valued wetland system tributary to the Russian River about 14 miles downstream. Most urbanization in Sonoma County lies within the 254-square-mile watershed of the Laguna. Storm runoff into this complex of wetlands is significant greater than 100 years ago. So we believe that any effort to reduce peak flows and volumes will be valued, particularly since Sonoma Mountain Village is one of the farthest sites that could contribute storm runoff, with additional runoff possibly reaching the Laguna when it begins to provide floodwater storage during Russian River floods. Similarly, measures to improve stormwater quality are important to the ecologic health of the Laguna. Also, the Laguna de Santa Rosa Foundation is presently in an intensive effort to control *Ludwigia*, an invasive aquatic plant which severely degrades the habitat and biodiversity values of the larger wetland system. Therefore we are aware that aquatic weed control must be a consideration should surface water be stored at Sonoma Mountain Village in the Cotati watershed.

Lichau Creek and Petaluma River

The southern portion of the site drains to Lichau Creek, Petaluma River, and the Petaluma Marsh – the largest remaining salt marsh adjoining San Pablo Bay and one of the great intact salt marshes of California – all affording important habitat, riverine and wetland values. Lichau Creek, in particular, is the focus of many ongoing bank stabilization and riparian restoration efforts. Since the stream is already constrained by increases in flood flows from many sources, Sonoma Mountain Village can perhaps best contribute to long-term channel stability by reducing peak flows and controlling storm runoff to protect stormwater quality. These goals are congruent with multifaceted efforts to reduce the number and severity of flooding events along the Petaluma River; for the southern part of the Sonoma Mountain Village site, the river system will benefit from delaying the arrival of storm runoff to the Petaluma lowlands.

Cities of Rohnert Park and Cotati

Ground Water: The City of Rohnert Park seeks to manage ground-water extraction so as not to cause substantial lowering of ground-water levels in areas adjacent to its urban growth boundary, as well as within the City. The City's emphasis is on use of and storage of the City's component of Russian River waters, and on conjunctive use such that ground water use can be maximized during droughts.

Creeks: Although none of the City's designated creeks are in or near Sonoma Mountain Village, drainage from the project area enters improved channels flowing to the Laguna de Santa Rosa channel downstream from the railroad, and measures which will stabilize downstream creek banks and preserve natural creek channels and riparian vegetation would be consistent with the City's policies. One of several potential approaches to meeting this goal might be to not increase peak discharges of channel-forming events.

Water Quality: Rohnert Park seeks to protect water quality in the SMV area through policies which prevent contamination of surface and ground water resources, minimizing ground-water depletion, and protecting recharge. Measures minimizing use of contaminants, maximizing recharge, and avoiding ground-water depletion in presently developed aquifers would help contribute to achieving these goals.

Cotati's stream and water policies, currently being updated, are generally consistent with those of Rohnert Park. In the interim, it is worth noting that drainage, channel stability and sedimentation, and invasive plants are primary among issues identified by Cotati Creek Critters, an established citizens' group dedicated to preserving and restoring the community's streams, sponsored by various state agencies and regional foundations.

No doubt other program goals and policies will influence how Sonoma Mountain Village can best address its water-related responsibilities to its neighbors, both uphill and downstream. These will continue to help shape the water planning for the site. They will also be formally evaluated as part of the environmental impact report process.

Verification

We suspect that there will be some environmental groups that will be ready to question our commitment to protect the environment whilst we build our community. Therefore we suggest and will promote the formation of a diverse verification board to review our construction activities and verify that we are acting as good stewards.

We envision this verification board as an ad hoc committee open to the public with an executive board of 3 to 5 people. The executive board would have regular access to the site and a recognized advisory role to alert the developer to any concerns and, if needed, take the issue to regulatory officials.

Water Needs

One of the most important portions of the local and regional hydrologic cycles at Sonoma Mountain Village is that related to water demand. This section of the Water Plan describes the historical water allocation and usage at the site, and explains the changes to that allocation over time which Codding Enterprises is requesting as part of the re-zoning of the property. Our objective is to identify how demand changes as more buildings are developed.

Our analysis addresses municipally-supplied drinking water separate from other water needs, a particularly important distinction in the case of Sonoma Mountain Village where a wide-range of innovative water conservation and management strategies will be implemented concurrently. In fact, we plan to utilize municipal drinking water supplies for a very limited number of uses as shown below.

Municipal Drinking Water Supply	Reclaimed Water	Stormwater Reuse
All usage inside buildings Irrigation in private backyards	Irrigation of all public parks, medians and street trees Irrigation of all common areas in HOAs Irrigation of all private front yards Fire hydrants	Habitat maintenance Groundwater recharge Supplemental irrigation supply for all landscape areas

Historical Usage

Sonoma Mountain Village is a property that is made up of two assessor's parcels with a total area of 175.3 acres. Agilent owned both parcels until they were sold to Sonoma Green L.L.C. @ K.D.R.P. L.L.C. in March 2005. The historical water allocation to the site is 287.13 AFY, based on a figure of 1.638 AFY usage per acre of developed property from the City of Rohnert Park's water supply assessment consultant (175.3 acres x 1.638 AFY = 287.13 AFY).

Planned Usage: Municipal Drinking Water

We have prepared preliminary estimates of municipal drinking water needs for traditional development approaches and for the sustainability-inspired design we will actually construct. Our estimated usage is built up from the residential units, commercial square footages and landscape areas shown on the Regulating Plan and described in Appendix A. We understand that the rates used to develop this preliminary analysis will need to be formalized and accepted by the City of Rohnert Park, and we also recognize that there are differences in how the City and Sonoma County Water Agency determine usage rates per their existing guidelines, many of which do not anticipate the level of conservation measures that will be implemented.

Tables 1 and 2 summarize our estimates of usage for the Sonoma Mountain Village site with and without sustainable water use practices. More detail on the background calculations are presented in Appendix B. The values for sustainable practices represent our estimate of the additional savings that will result from implementation of the Water Plan. We feel it is reasonable to set a preliminary goal of reducing overall municipal supply needs by 40 percent from the general norm that applies in the region for single-family homes and 23 percent from the demand without the sustainable water use measures (Table 2).

Table 1. Preliminary Estimate of Residential Water Conservation Potential[2]

Residential Unit Type	Residents per Unit	Standard Water Use: Indoor Water Use	Standard Water Use: Outdoor Water Use	Standard Water Use: Total Water Use	Sustainable Development: Indoor Water Use	Sustainable Development: Outdoor Water Use	Sustainable Development: Total Water Use	Overall Savings
	(#)	*(gal/day/person)*	*(gal/unit/day)*	*(gal/unit/day)*	*(gal/day/person)*	*(gal/unit/day)*	*(gal/unit/day)*	*(%)*
Attached Residential Lofts/Condos	3.2	65	80	288	52	60	226	21%
Lofts/Condos/Apts/SROs @ 25 units/acre	2.2	65	40	183	52	25	139	24%
Lofts/Condos/Apts/SROs @ 45 units/acre	2.2	65	20	163	52	12	126	22%
Live-Work Units	2.2	65	40	183	52	25	139	24%
Rowhouses/Townhouses	2.2	65	80	223	52	60	174	22%
Detached Housing	3.2	65	150	358	52	110	276	23%
Detached Housing with Granny Unit	4.2	65	150	423	52	110	328	22%

Table 2. Preliminary Estimate of Municipal Water Supply Needs

Commercial and Public	Area	Standard Water Use: Total Use	Standard Water Use: Annual Demand	Sustainable Development: Total Use	Sustainable Development: Annual Demand	Savings
	(sq ft)	*(gal/day/1000 sq ft)*	*(AFY)*	*(gal/day/1000 sq ft)*	*(AFY)*	*(%)*
Retail	81,500	30	2.7	24	2.2	20
Cafeteria & Theater	22,400	55	1.4	44	1.1	20
Mixed Use/Office/Light Industrial	367,120	50	20.6	35	14.4	30
Athletic Club	56,630	260	16.5	208	13.2	20
			41.2		30.9	25

Residential	Number Units	Standard Water Use: Total Use	Standard Water Use: Annual Demand	Sustainable Development: Total Use	Sustainable Development: Annual Demand	Savings
	(#)	*(gal/unit/day)*	*(AFY)*	*(gal/unit/day)*	*(AFY)*	*(%)*
Attached Residential Lofts/Condos	59	288	19.0	226	15.0	21
Lofts/Condos/Apts/SROs @ 25 units/acre	156	183	32.0	139	24.4	24
Lofts/Condos/Apts/SROs @ 45 units/acre	714	163	130.4	126	101.1	22
Live-Work Units	86	183	17.6	139	13.4	24
Rowhouses/Townhouses	443	223	110.7	174	86.5	22
Detached Housing	98	358	39.3	276	30.3	23
Detached Housing with Granny Unit	336	423	159.2	328	123.6	22
	1,892		508.2		394.4	22

Table 3. Comparison of Three Scenarios[3]

	Project with Average Rohnert Park Density	Sonoma Moutain Village Density	Sutainable Development
Total Estimated Municipal Demand	703.0 AFY	549.4 AFY	425.2 AFY
Existing Allocation	287.1 AFY	287.1 AFY	287.1 AFY
Additional Allocation Requested	415.9 AFY	262.3 AFY	138.1 AFY

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2 Average indoor water use taken from the 2005 Urban Water Management Plan prepared by the East Bay Municipal Utility District and the Green Building Guidelines prepared by Sustainable Buildings Industry Council. Outdoor water demand based on data presented in Lawns and Water Demand in California published in California Economic Policy by the Public Policy Institute of California (July 2006).

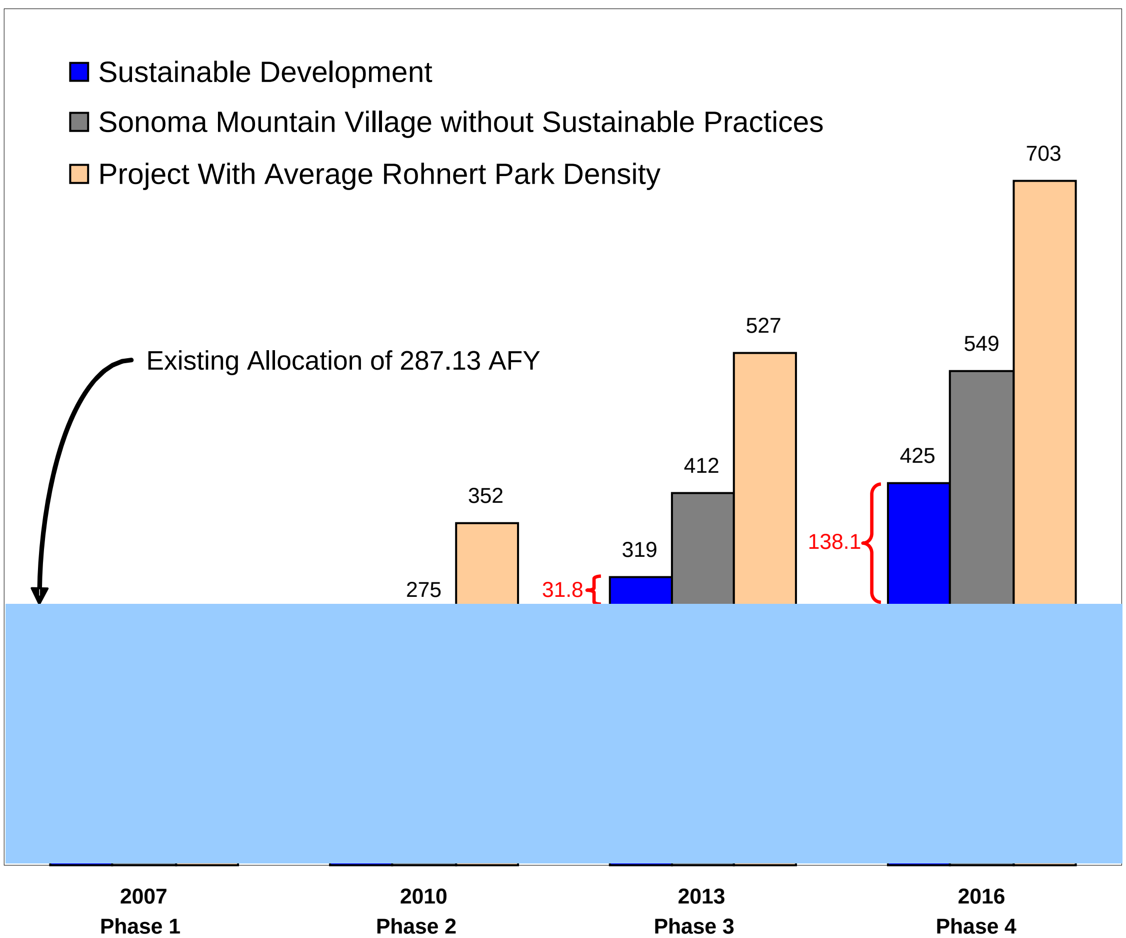
3 Average Rohnert Park density values calculated using a single-family detached unit density of 10 units per acre applied to the entire project area of 175.3 acres.

In total, the water conservation and reuse measures will reduce total municipal water supply demand to approximately 425.2 AFY or 138.1AFY above the existing allocation for the site. Under traditional development plans, the project would need to request an additional allocation of at least 415.9 AFY above the existing allocation.

Because Sonoma Mountain Village will be built in phases over 10 to 15 years, the additional allocation will not be needed all at once. The blue bars show our planned usage with strict conservation measures saving about 40% from typical development levels and 23% from compact development designs.

Figure 3 shows demand rising to meet the existing allocation for the ex-Agilent property for the first time around 2013. Therefore, we believe we have a sufficient water allocation for at least the first two phases of construction, and have increasing demand requiring incremental allocations of roughly 32 AFY in 2013 and 138 AFY in 2016. Additionally, the calculations in Tables 1, 2 and 3 do not include the possible contributions to increased supply through enhanced groundwater recharge and/or stormwater reuse at the site.

Figure 3. Estimated Municipal Water Supply Needs Over Time in Acre-Feet per Year



Planned Usage: Reclaimed Water

One of the most important reductions in municipal drinking water demand will be realized through an ambitious use of reclaimed water to meet a large portion of the irrigation demands. Reclaimed water will be the source for landscape irrigation water for all areas in the public realm (open space, sidewalks) and a portion of those in the private realm (residential front yards).

The projected water use for landscape irrigation was calculated using the Landscape Coefficient Method as outlined in A Guide to Estimating Irrigation Water Needs of Landscape Plantings in California, published by the California Department of Water Resources as shown in Table 3. This method uses a series of calculations to estimate the evapotranspiration, or water lost from the leaf canopy of landscape plant groupings. The quantity of water lost from a plant grouping during a specific time period gives an estimate of the amount needed to be replaced by irrigation. This value is based on species plant choices, density of plantings and specific microclimatic conditions, as well as reference evapotranspiration data for the region. Calculation of the total amount of water to supply also takes into account the efficiency of the irrigation system.

In general, the landscape protocol for Sonoma Mountain Village will be groupings of plant species native to California and species adapted to the local climate. There will be minimal use of lawns or turf areas in residential front yards or sidewalk planting strips. Turf areas will be limited to neighborhood parks, plazas and private back yards. Street trees will be chosen for heartiness, shade and beauty.

Additionally, high-efficiency irrigation systems including sub-surface drip tubing and WeatherTrak ET irrigation controllers will reduce the irrigation water needs.

The total projected reclaimed water use for irrigation at Sonoma Mountain Village is approximately 98 AFY for public spaces and private front yards. This projected water use for irrigation is in the low range for similar developments in the western U.S., which is reasonable given the efficiency of the irrigation equipment that will be installed. Typical average water use for similar developments is in the range of 105 to 116 AFY. Actual irrigation usage may be considerably lower when corrected for rainfall, stormwater reuse and other factors.

These calculations are based on eventual irrigation water use after all phases of construction are complete and landscape plantings have reached maturity. Interim water use could be higher or lower per year, depending on factors such as phasing of construction and water needs for establishing young plants. Therefore, these water use estimates are preliminary and likely to be refined as the landscape design is refined.

Table 3. Preliminary Estimated Irrigation Water Use: Annual Irrigation Water Budget

SUMMARY					
	Total Area[1]		Water Use Data[2]	Projected Water Use	
PROPOSED USE[1]	(SQ FT)	(Acres)	Gal/ SQ FT/year	(Gallons/day)	(Acre ft/year)
Private - Apartment Front Yards	81,022	1.86	16.64	3,694	4.14
Private - Single Family Front Yards	266,587	6.12	16.64	12,153	13.61
Private - Rowhouse Front Yards	51,836	1.19	16.64	2,363	2.65
Subtotal Private Areas	**399,445**	**9.17**		**18,210**	**20.40**
Public - Open Space					
Neighborhood Parks	402,650	9.24	24.20	26,696	29.91
Greenway	729,800	16.75	9.07	18,135	20.32
Central Plaza	36,750	0.84	21.78	2,193	2.46
Subtotal Open Space Areas	**1,169,200**	**26.83**		**47,024**	**52.68**
Public - Mixed-Use Landscaping					
Apartment Frontage (Front Yards behind sidewalk)	38,768	0.89	16.64	1,767	1.98
Shopfront & Awning Frontage	0.00	0.00	0	0	0.00
Detached Sidewalks	23,787	0.55	18.45	1,202	1.35
Attached Sidewalks	21,625	0.50	16.64	986	1.10
Subtotal Mixed-Use Landscaping	**84,180**	**1.93**		**3,956**	**4.43**
Public - Detached Sidewalks	280,091	6.43	18.45	14,158	15.86
Public - Attached Sidewalks	87,050	2.00	16.64	3,969	4.45
Subtotal Sidewalks	**367,141**	**8.43**		**18,127**	**20.31**
TOTALS	**2,019,966**	**46.36**		**87,317**	**97.81**

COMPARATIVE STUDIES					
	Total Area[1]		Water Use Data	Irrigation Water Use	
Reference	(SQ FT)	(Acres)	(Gal/SQ FT/year)	(Gallons/day)	(Acre ft/year)
Typical Water Duties for Parks - Average Development[3]	2,020,123	46.36	16.93	93,700	104.91
Water Deficit Method - Average for Rohnert Park[4]	2,020,123	46.36	18.70	103,497	115.91

NOTES

1. Urban Design Background Assumption Information for Water Use Calculations, Fisher & Hall, 2006.
(Difference in total acreage due to assignment of square footage values instead of # of trees for Attached Sidewalk categories.)
2. Projected water use calculations based on 'The Landscape Coefficient Method' as defined by A guide to Estimating Irrigation Water Needs of Landscape Plantings in California, University of California Cooperative Extension and California Department of Water Resources, 2000.

Water Conservation & Wastewater Management

The water needs analyses presented above are predicated on the implementation of a comprehensive set of water conservation measures and standards throughout the project. From a sustainability perspective the savings from water conservation and innovative wastewater management reach far beyond the water itself. For example, 80 percent of the cost of delivering water generally stems from the energy requirements for pumping, processing and treating the water.

We are in the process of refining the suite of conservation measures that will be required by this Plan. The following are several specific items under that will likely be integral components of the conservation strategy.

Construction

Dust Suppression

Dust suppression is important for controlling local air pollution, but it can be achieved without the use of drinking water. Through a combination of gravel driveways for truck access and temporary hydroseeding of disturbed soil, we will reduce the need for dust suppression water spraying on site. We will also use reclaimed water for spraying, when needed.

Site Design

Soil Health and Preparation

Healthy soil structure and biological function play an important role in the soil's capacity to absorb and retain water from rain and irrigation. Both soil structure and soil biology are likely to be damaged during construction activities. Therefore, our approach to soil health includes minimizing that damage and improving the health of the soil after construction activities have been completed.

We recognize the value of healthy soil in contributing to the overall health of the water supply and natural systems. We further recognize that the clay-rich soil at Sonoma Mountain Village is fairly impervious and does not allow infiltration at a very high rate. As a result, we will improve the health and structure of the soil on site through protection and amendments.

Topsoil will be stockpiled during earth moving for later use. Before re-spreading topsoil after construction, the clay-rich earth will be amended with local compost to improve drainage and increase biological content and fertility.

Soil will be protected from compaction in infiltration areas such as the portion of the site in County jurisdiction that will remain undeveloped. During construction, trucks will not be allowed to park in these areas, for example. In areas where construction activities will require excavation, soil moving and soil compaction, restoration practices could include re-grading and addition of topsoil where necessary, temporary and permanent seeding of bare soils, treatment of soil in landscape areas with additions of organic matter and myco- and bio-remediation.

Newly landscaped areas will be top-dressed with a minimum of 2 inches organic mulch to reduce water loss to evaporation and contribute to soil fertility.

We intend to limit the impact of any necessary soil stabilization treatments so as to preserve the quality of soil for growing and to reduce the potential for increasing the pH of stormwater flows (such as from lime treatment).

Plant Selection and Hydrozoning

The plant palette will be selected to perform well on this particular site with modest water needs. There will be a minimal use of lawns or turf areas in residential front yards or sidewalk planting strips. Turf areas will be used in neighborhood parks and plazas.

In addition to drought tolerance, plants will be non-invasive to support the efforts of local water agencies to combat problem plants such as ludwigia in the Laguna de Santa Rosa, and grouped by water need so that plants receive only as much water as required. This method of grouping plants with similar water needs together is referred to as ‘hydrozoning’, which reduces inefficiencies in irrigation.

Reducing green waste and maintenance is an important benefit of not overwatering and fertilizing. Another important way we will reduce green waste and further reduce plant watering needs is to select plants so that major pruning or mowing is not required. When plants are selected so that the mature plant will fit into the space provided, there is a little need for on-going trimming. This method means that the first two or three years of growth will look “thin” because plants have not yet filled in. However the long-term benefits are significant.

Irrigation

As discussed previously, landscape areas will be irrigated efficiently and with minimal use of municipal drinking water.

All irrigation systems installed at Sonoma Mountain Village will employ the latest high-efficiency technologies. Currently, the most promising of these is the evapotranspiration value or “ET” based irrigation controllers that track weather conditions through CIMIS satellite signals. These controllers combine weather forecast and current weather information with pre-programmed soil and plant-specific data to adjust water schedules as local weather changes. Use of ET controllers can reduce irrigation water use by up to 50% and reduces irrigation water runoff by 71%. In fact, the project is currently investigating setting up a climate station which would be part of the CIMIS network, providing excellent specific irrigation control information for this site and other locations in Rohnert Park and Cotati.

In addition to using intelligent controls, we will make use of an efficient combination of bubblers, drip lines, targeted sprayers, and subsurface irrigation. These technologies minimize evaporative losses and overspray.

We are planning to continue irrigating the property with reclaimed water to the greatest extent allowed. We know this will include parks, medians and front yards, and we are exploring the feasibility of irrigating backyards with reclaimed water or non-potable water from other sources as well. To distribute the reclaimed water, we plan on installing purple pipe in streets, including residential-only portions of the site.

While the local reclaimed water may have a higher salt content than City water, it does not appear to pose a problem for irrigating the site. Based on a preliminary assessment, Balance Hydrologics has observed that winter precipitation will be adequate to flush out any salt build-up from use of reclaimed water.

We are also investigating rainwater collection as an additional source of irrigation water, and will likely use the method somewhere on site. Candidate locations include buildings with underground parking (corners of parking garages can be used for water storage tanks), larger public spaces such as parks with room for cisterns, and homes with room for storage tanks in yards.

Fire Hydrants

We intend to use reclaimed water in our fire hydrant system and will explore supplementing this use if we can establish other reliable sources of water on site, such as captured rainfall.

Building Usage and Wastewater Minimization

The overall goal is to use 50% less water then budgeted by the LEED green building evaluation method based on the 1992 EPA Energy Policy Act, which regulates water efficiency in appliances and fixtures. Additional savings may be possible through the use of reclaimed water for cooling towers and fire sprinklers.

By reducing the use of water in toilets and urinals, we produce four kinds of benefits: (1) reduced demand on the Russian River, (2) reduced water supply costs, (3) reduced energy from pumping water and the related reduction in air emissions, and (4) reduction in the amount and cost of sewage treatment.

Cooling Towers

We intend to use reclaimed water in cooling towers along with chemical-free water treatment such as the pulse technology used in the Dolphin system by Clearwater Systems Corporation.

Showers

The project will use showerheads with flow rates of 1.5 gpm or less in all showers throughout the project. In addition, we will consider the use of water circulator pumps and point-of-use heaters wherever they help reduce water and energy use. Savings over a standard 2.5 gpm showerhead is 40%.

Faucets

Commercial lavatories will be installed with 0.5 gpm flow restrictors, breakroom sinks with 0.8 to 1.5 gpm, and janitor closets will be unrestricted to allow quick filling of mop buckets.

Residences will have 0.8 gpm flow restrictors in bathroom sinks and 2.0 gpm in kitchen sinks to allow quick filling of pots for cooking.

Toilets & Urinals

We intend to use toilets that use no more than 1.4 gallons per flush, on average. This could include dual-flush toilets with 0.8/1.6gpf or so called ‘high-efficiency’ toilets with 1.2 or 1.4gpf.

Urinals will be waterless throughout.

Laundry

To the greatest extent practical, we will encourage the use of horizontal axis washing machines and gas dryers. Line drying of laundry will be expressly allowed in HOA agreements.

In addition, we will work with real estate experts and potential home buyers to better understand how to provide shared laundry facilities in an appealing manner consistent with the overall project. We recognize the value of shared laundry facilities in improving affordability and promoting tourism.

Dishwashers

All residential dishwashers will be Energy Star compliant. We will also track the EPA’s new WaterSense program to find out if dishwashers will eventually be certified there as well.

Fire Sprinklers

We intend to use reclaimed water in the fire suppression systems in buildings.

Greywater

We are encouraged by Councilmember MacKenzie’s comments in support of greywater at the Sustainability Ordinance workshop, and would like to explore options for capturing and re-using greywater from various uses such as laundry and fire station pump test and truck wash areas. A conversation about allowed sources of greywater would be helpful in expanding our list of potential water sources.

Renewing Groundwater

Understanding the details of the local hydrologic cycle will be key in understanding the amount of water available for recharge and storage in the groundwater system. Water stored in shallow soils may be available for evapotranspiration during dry months. Water that can penetrate into the deeper sediments (below root depths) would recharge the groundwater system. As such, an understanding of the soils and underlying geology is required.

The dominant soil at the site is Clear Lake clay. As the name implies, this is a very clay-rich soil. Permeability is low, runoff is slow (due to gentle slopes) and erosion hazard is slight. It is associated with poorly drained basins and floodplains.[4] Luhdorff and Scalmanini indicate soil permeability in the area is less than 0.5 cm/hr (<0.02 inch/hr).[5] The available water-holding capacity of typical Clear Lake clay is 8 to 10 inches.

During the dry season, large cracks can be observed in the soils at the site (Figure 4). This reflects the high clay content and contraction during seasonal drying. Intersecting cracks produce a columnar soil structure, which is common in clay-rich soils. During the initial-wetting storms at the onset of the rainy season we expect that soils would absorb a great deal of moisture. While cracks remain open, water could penetrate into the deeper sediments, below the Clear Lake clay. Once the soil hydrates and cracks close, infiltration would decrease and rain would pond or quickly runoff. At this point, recharge to the groundwater system diminishes for the remainder of the season.

Figure 4. Large cracks developed in Clear Lake clay on the southern half of the site.

4 Miller, V.C., 1972, Soil Survey of Sonoma County: U.S.D.A. Forest Service and Soil Conservation Service, in cooperation with the University of California Agricultural Experiment Station, 188 p.

5 Luhdorff and Scalmanini Consulting Engineers, 2005, City of Rohnert Park City-wide Water Supply Assessment: Report No. 04-205627-020.

Soils at the site do not necessarily reflect the underlying geology and are likely a deposit from flooding and/or mudflows. The clay-rich soil is probably a few feet thick (3-6 ft) as is observed in the banks of nearby Lichau Creek where it crosses Petaluma Hill Road (Figure 5). The dark gray color of the clay and the presence of volcanic cobbles suggest that it is derived from volcanic rock and tuff, such as found in the Sonoma Mountains. Pebbles and cobbles mixed in the soil also suggest transport by high energy or dense (clay rich) flows, such as mud flows or floods.

Figure 5. South bank of Lichau Creek just west of Petaluma Hill Road. Clear Lake clay and underlying interbedded Petaluma and Wilson Grove Formations exposed along the banks.

A clear understanding of local geology and local groundwater flow patterns is essential. The site is flanked to the southwest by the Sebastopol Fault (which trends northwest) and to the northwest by the Sonoma State Fault (which trends northwest through Sonoma State University.) These and unmapped faults likely influence groundwater flow patterns. Subsurface geologic units in the area include the interbedded Wilson Grove Formation (marine sediments) and Petaluma Formation (non-marine sediments), and Sonoma Volcanics. Local sandstone and conglomerate (or sand and gravel) in these units, if present, could store and produce fresh water. For example, logs from a well at the east-central boundary of the site (6/7-31L1; Cardwell, 1958) reported a yield of 20 gallons per minute from sand and gravel between 50 and 75 feet depth (perforated casing at 54 to 64 feet.) Sandstone is also reported at 3 to 8 ft and the static water level was 13 feet deep. Similar shallow sand/sandstone can be seen on Lichau Creek at its crossing on Petaluma Hill Road. Given that the soils differ from the underlying geology, it is possible that recharge basins could be created in areas that are stripped of the clay-rich soil, exposing sandstone. However, we expect a great deal of variability in the geology underlying the Clear

Lake clay. For example, surrounding wells (6/7-31G1 and J1, 6/8-36A1; Cardwell 1958)[6] indicate significant thickness of clay below the soil. Detailed studies of soil and shallow geology are ongoing to further define recharge areas.

The soils and geology of the site tell us two important things: first, clay-rich soils might provide a short window of opportunity under natural conditions for recharge (while soil cracks remain open) and, second, even during this window the underlying geology might be clay rich, inhibiting recharge. Much of the water in the system is likely returned to the atmosphere via evaporation and transpiration – evapotranspiration. Reference evapotranspiration rates at local CIMIS stations (Santa Rosa and East Petaluma) are large: 44 and 45 inches. This is potential evaporation and reflects loss from a grass field with unlimited water from irrigations (ETo). Actual evapotranspiration rates with native groundcover would be lower. For example, the USGS estimated 12 inches of annual runoff and 30 inches of annual rainfall for watersheds in the area of Santa Rosa.[7] This suggests that actual evapotranspiration averages no more than 18 inches, unless water is provided by natural seepage or by irrigation or ponding.

A more complete understanding of the soils, geology and hydrologic cycle of the site will provide insight into the seasonality and intensity of runoff, storage in soils, actual evapotranspiration, and a more complete understanding of the communication between surface water, soil storage and deeper groundwater.

6 Cardwell, G.T., 1958, Geology and Ground Water in the Santa Rosa and Petaluma Valley Areas, Sonoma County, California: U.S. Geological Survey Water-Supply Paper 1427, 273 p.

7 Rantz, S.E., 1971, Precipitation-Duration-Frequency Relations for the San Francisco Bay Region California with Isohyetal map of San Francisco Bay Region, California, Showing Mean Annual Precipitation, 1931-70: Miscellaneous Field Studies Map MF-612, San Francisco Bay Region Environment and Resources Planning Study, U.S. Geological Survey, and U.S. Department of Housing and Urban Development.

Rantz, S.E., 1974, Mean Annual Runoff in the San Francisco Bay Region California, 1931-70: Miscellaneous Field Studies Map MF-612, San Francisco Bay Region Environment and Resources Planning Study, U.S. Geological Survey, and U.S. Department of Housing and Urban Development.

Stormwater Management

A very important aspect of sustainability at Sonoma Mountain Village is the consideration of potential hydromodification impacts in framing the stormwater management strategy. Hydromodification is the term used to describe the suite of changes (with respect to pre-project conditions) in key hydrologic parameters that can result from all types of development. Examples include increases in peak storm discharges; shifts in the magnitude, duration and frequency of channel forming flows; increases or decreases in annual ground water recharge; and increases in annual runoff volume. The project will be designed to minimize and avoid potential off-site impacts from hydromodification, primarily by maintaining peak flows at or below current levels and providing for stormwater controls that mitigate for the potential increase in runoff that would otherwise accompany development of the site.

In fact, the project represents a special opportunity with respect to the Laguna de Santa Rosa watershed. Roughly 124 acres (71 percent) of the Sonoma Mountain Village site currently drains to the Laguna de Santa Rosa watershed via Cotati Creek. Most importantly, essentially all of the existing development on site is located in this watershed. This development includes roughly 57 acres of impervious surfaces (buildings, roads, parking lots) that were constructed before best management practices to control stormwater quantity and quality were generally required. Because of the aggressive goal to manage and reduce runoff, re-developing the site will improve the functions and values of both Cotati Creek and Lichau Creek.

Construction-phase practices will be covered in detail with a Stormwater Pollution Prevention Plan (SWPPP) and post-construction stormwater management will be thoroughly covered in a comprehensive Stormwater Management Plan (SWMP).

Approach

Urban development can alter the hydrology of watersheds in a number of significant ways depending on both the nature of the watershed and the development. Perhaps the most significant of these impacts results from increasing the area of low or zero infiltration capacity in the watershed and by increasing the rate at which runoff is delivered to channels. Such land surface changes typically result in increased storm runoff volumes and peak flows. Urbanization can also cause temporary increases in sediment yields to channels, and, in some instances, a reduction in the length of stream channels available to convey the increased runoff and sediment loads.

Stream channels respond to the balance between the supply of sediment from the watershed and the capacity of the flow to transport that sediment. Therefore, changes in the amount and timing of water and sediment delivery following urbanization may induce changes in channel geometry and habitat conditions downstream. In most small watersheds largely converted to urban and suburban uses, increased flow and sediment supply have led to channel enlargement as a result of bed and/or bank erosion. The fact that net channel erosion is more common than net deposition implies that the increase in flow caused by development tends to predominate over increases in sediment supply. Deposition, however, eventually occurs, as presently affects creeks in Cotati and the larger Laguna de Santa Rosa downstream.

The approach to mitigating potential hydromodification impacts will be based on maintaining overall runoff rates as close as possible to those that would characterize the site under existing conditions, allowing for control of peak flow rates from the site over a full spectrum of storm intensities. The latter aspect of the strategy will allow the project to make meaningful contributions to flood control for both Cotati Creek and Lichau Creek, consistent with regional efforts to reduce flooding in the Laguna de Santa Rosa, Russian River and Petaluma River.

Stormwater Runoff Volume Controls

Introducing impervious surfaces into a natural watershed almost invariably increases runoff volume. The impact is much more pronounced in sandy areas or areas with soils derived from volcanic substrates where the natural infiltration rates may be quite high. Our preliminary site investigations lead us to conclude that the clay-rich soils at the site do not allow for much infiltration and this will help to reduce the magnitude of potential hydromodification impacts.

Nonetheless, the high-density of the proposed land plan calls for a number of measures to limit overall runoff rates and, in the case of the northern portions of the site, reduce existing runoff rates as a remedial measure in the headwaters of Cotati Creek and the Laguna de Santa Rosa. The project will include a number of recognized best management practices in this regard all of which share a common goal: reduce runoff volume by recharging stormwater and/or storing stormwater for re-use. Clearly, recharging stormwater will require careful design to assure that the infiltrated runoff quality is appropriate and compatible with the characteristics of the aquifer.

Impervious Surface Controls

We will explore the use of pervious surfaces for roadways as appropriate for vehicle demands and speeds. The network of alleys is a likely candidate for such pervious surfaces because of the lower traffic volume. Combined with an underdrained substrate, this design will markedly reduce peak runoff from alleyways and rear buildings.

Biofiltration Swales and Rain Gardens

Wherever practical, biofiltration swales and/or rain gardens will be the primary initial catchment for runoff from the main street networks and from roof leaders on larger buildings. Where subsurface conditions allow, these features will drain filtered water to the underlying aquifer, thereby reducing runoff volumes while increasing recharge of the local groundwater system.

Use of Street Trees with Structural Soil

The landscaping plan for the project requires the use of street trees, some likely requiring structural soil. This material will provide additional areas for the transient storage and percolation of stormwater.

Infiltration Galleries and Cisterns

Where space restrictions or land use considerations limit the use of biofiltration areas or rain gardens, the project will use underground infiltration galleries to store and percolate runoff. Excellent locations for these features include under recreation facilities (such as the proposed soccer field) and in other commons areas where surface ponding of runoff would be undesirable.

Essentially the same design, with an impermeable bottom, can be used to store runoff as part of the stormwater reuse system. Again, ideal locations would be under or next to turf areas such as public park spaces where the captured water could be used locally to irrigate turf and other landscaping, thereby replacing a portion of the reclaimed water demand. Another excellent location would be at public facilities, such as fire stations or maintenance yards, where the captured stormwater could be used for equipment washing and other non-potable uses.

Flood Control

Although Sonoma Mountain Village is not located in a mapped flood zone, a truly sustainable community must consider potential impacts to flooding and flood risk both locally and regionally. Therefore, the project design will include additional features to regulate peak stormwater flows and will coordinate design and operation of stormwater detention facilities to support ongoing flood control efforts being undertaken by the City of Rohnert Park, City of Cotati, Town of Penngrove and Sonoma County Water Agency among others.

Surface channels

In addition to increased impervious area, one of the major contributing causes of the increases in peak stormwater flows that generally accompany development is the transformation of a natural drainage channel system to a piped system. The loss of channel storage and increased flow velocities in a piped system both lead to faster runoff that is usually characterized by significant increases in peak flow.

This tendency will be countered at Sonoma Mountain Village by constructing a channel corridor in the large greenway area that runs the length of the site along the existing railroad right-of-way. We feel that the size of the greenway will allow us to create an important trail corridor and attractive landscape buffer while leaving room to construct a channel system that includes overbank storage for flood flows (contained in the greenway). With proper design, the channel corridor will also encourage groundwater recharge throughout its length. This corridor, though it will not “restore” a specific pre-existing feature, can provide functions and values similar to the historic channel networks that probably crossed the lowermost portions of the Copeland/Lichau alluvial fan complex before they were diverted into the ditches and drains along Petaluma Hill Road.

Detention basins

Detailed hydrologic and hydraulic modeling of the overall stormwater management system is currently underway. To achieve our goals of limiting hydromodification, some detention storage may be needed to ensure that there are indeed no increases in peak stormwater flow rates from the site.

This will almost certainly be true at the southern end of the site, where the drainage to the Lichau Creek system crosses Railroad Avenue. The project has identified an area of approximately 1.3 acres just north of the existing PG&E substation for the possible location of a stormwater management basin. This basin would allow control of peak stormwater outflows across Railroad Avenue and, depending on the local groundwater hydrology, could be configured to further augment recharge and/or serve as a holding facility for captured runoff or excess reclaimed water.

Pollution Prevention during Construction

Nationally, the average construction site adds 30 tons of sediment per acre into nearby waterways. While the Bay Area generally has more stringent erosion control standards, we recognize that construction is still a major source of water pollution. With Sonoma Mountain Village, we will protect against erosion and contamination with the best practices available.

Protected Areas

Pollution prevention during construction is of special interest given that both the Laguna de Santa Rosa and Petaluma River are on the U.S. EPA/Regional Water Quality Control Board 303(d) list of impaired water bodies. Both streams are listed for impairment by sedimentation/siltation, a particular concern with construction activities. Additionally, the Laguna de Santa Rosa is listed for phosphorus, which is often mobilized along with sediment.

Measures against Erosion, Sedimentation and Contamination

This project will create and implement a thorough Stormwater Pollution Prevention Plan (SWPPP) which conforms to the erosion and sedimentation requirements of the 2003 EPA Construction General Permit and local codes and best practices.

To the greatest extent practical, construction vehicle access to the site will be on existing and new asphalt roads. Storm drains will be protected with filter strips and settling areas as needed, and any significant vehicle use off roads will be preceded by soil stabilization with gravel and the use of additional silt fences and earthen dikes.

We intend to balance cut and fill on site, and minimize the need for stockpiling during construction. However, a significant amount of concrete and asphalt debris will be generated as existing roads and some structures are removed, and we intend to re-use all of this material on site. Stockpiling of these materials will require the use of appropriate containment areas to prevent oils and concrete dust from mobilizing.

Temporary seeding and mulching will be used to stabilize bare soils throughout the project, likely with a mix of plants such as California Brome, Blue Wild Rye, Three Weeks Fescue, California Buckwheat, Blue Lupine and California Poppy.

Silt fences, sediment traps, basins and biofilters will be used as components in the comprehensive SWPPP as outlined in the Best Management Practices Handbook for Construction Projects.

Post Construction Water Quality Management

The sensitive nature of the important aquatic resources located downstream of Sonoma Mountain Village calls for a comprehensive stormwater quality management strategy as well. We feel that the measures discussed above, along with additional features described below will allow us to complete a Stormwater Management Plan (SWMP) that goes well beyond the requirements of the North Coast and San Francisco Bay Regional Water Quality Control Boards and other local agencies.

The overall strategy will be to provide an integrated suite of best management practices (BMPs) that effectively treats a minimum of 80 percent of the mean annual runoff from the site. This standard will be met even though the project will produce markedly less overall runoff than a traditional project of its size. The suite of BMPs will be based on a hierarchical approach to water quality management that incorporates site design elements, source controls and treatment controls. The site design and treatment controls have been covered in previous sections of this Plan. Source control practices will include, but not be limited to:

Chemical Application Management

We will restrict the use of certain fertilizers through HOA and leasing agreements. Synthetic, quick-release fertilizers will not be used on site. Compost and naturally-derived fertilizers will be used extensively, and slow-release synthetic fertilizers will be allowed in private areas, but generally discouraged.

Homeowner Education

Each homeowner will receive a manual welcoming them to the neighborhood and describing how to maintain their home. In these manuals, we will provide educational material on where their water comes from and where it goes after their use. Instead of simply listing prohibited activities, the manual will provide information about why the activities are prohibited. For example, irrigating a private yard with sprinklers on a summer afternoon is not allowed because it wastes water. Depending on the sprinkler type and weather, anywhere from 10% to 60% of the water evaporates instead of getting absorbed into the soil. When yards are watered at night, most of water gets absorbed.

Pools & Spas

We will identify preferred treatment methods and chemicals for use in pools and spas and ensure that only these better treatment options are allowed. We will also establish procedures for the proper draining of pools and spas.

Car Washing

Washing cars will probably be allowed in alleys, but not in streets. Outdoor use of soaps will be strictly limited through HOA rules to reduce site and runoff contamination.