

**WHATCOM COUNTY
SURFACE MINING
ADVISORY COMMITTEE**

FINAL

REPORT AND RECOMMENDATIONS

October 20, 2004

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Preface

State law requires counties to designate and protect mineral resource lands (MRLs) of long term significance (RCW 36.70A.060, 36.70A.170, and 36.70A.040). The Whatcom County Council adopted interim MRL designations in 1992 (Ordinance 92-028). These interim designations were replaced by final MRL designations when the Whatcom County Comprehensive Plan was adopted in 1997 (Ordinance 97-023). The mineral resource section of the 1997 Comprehensive Plan summarized the role of the previous Surface Mining Advisory Committee (SMAC) in formulating the Plan:

To address the mandates of the Growth Management Act, Whatcom County formed a Surface Mining Citizens' Advisory Committee to produce, through a consensus process, the issues, goals, and policies found in this chapter. Planning staff drafted the subsection on mineral designations following review and comments from the committee. The committee was comprised of a cross-section of community members including mining operators, foresters, farmers, and rural homeowners representing diverse interests and geographic areas in Whatcom County (p. 8-18).

The 1997 Comprehensive Plan also contained Mineral Resource action item 5 to “. . . Maintain an ongoing advisory committee consisting of representatives of diverse interests” to address mineral resource issues.

The County Council formed the current edition of the SMAC in 2000 when it adopted Ordinance # 2000-017. This ordinance, which is now codified as Whatcom County Code 2.120, indicates that the SMAC's function is to address the mineral resource action items in the Whatcom County Comprehensive Plan. The current members of the SMAC are:

- ✓ Scott Babcock, Geologist representative
- ✓ Cleo Callen, Material user representative
- ✓ John Matzinger, Engineer representative
- ✓ Alvin Starkenburg, Surface mining industry representative
- ✓ John Van Boven, Surface mining industry representative
- ✓ Jerry Van Dellen, Agriculture/Conservation District representative
- ✓ Tom Westergreen, Forestry representative
- ✓ Peter Willing, Ground water representative

The Citizen, ecologist, and environmental consultant positions are currently unfilled.

Doug Goldthorp, Matt W. Aamot and Janet Morello of Whatcom County Planning & Development Services provided staff support for the SMAC.

The SMAC adopted a Work Plan for 2004 that indicates the goal of the SMAC in 2004 is to address Action Item # 9 of Chapter 8 of the Whatcom County Comprehensive Plan, which states:

The Mineral Resource Land map designations and/or designation criteria should be reviewed at least once every seven years to determine if changes are necessary to meet mineral resource goals and policies. Such review should include consideration of the removal of land from Mineral Resource Designation after mining activity is completed and the addition of new designations in order to maintain a 50-year supply of mineral resources. Review may occur through subarea plan updates provided a complete review will occur within the seven year time frame.

The committee formally commenced consideration of Action Item 9 on February 25, 2004 and met 16 times over the following 8 months. The committee issued its final report and recommendations on October 20, 2004.

In formulating the recommendations, the SMAC considered Report Engineering Geology Evaluation Aggregate Resource Inventory Study Whatcom County, Washington, (GeoEngineers, Inc., Sept. 2003) and Reconnaissance Investigation of Sand, Gravel, and Quarried Bedrock Resources in the Bellingham 1:100,000 Quadrangle, Washington, (Loen, Jeffrey S. et al. January 2001). The SMAC also reviewed GIS generated data and maps of potential resource areas depicting:

- Comprehensive Plan and zoning designations
- Agriculture protection overlay soils
- Aerial photo with boundaries of individual parcels
- Average parcel size with particular areas
- Streams and wetlands
- Wellhead protection areas of public water systems, and
- Major pipelines.

The SMAC also considered the knowledge and expertise of individual members of the committee in formulating the conclusions in this report.

This report contains the committee's recommendations and is organized in four primary components: (1) A summary of 50-year demand and the supply of mineral resources in existing

MRLs, (2) major findings and conclusions of the SMAC, (3) proposed Comprehensive Plan amendments, and (4) appendices containing detailed findings and conclusions of the committee relating to the 50-year demand projection, mineral resource supplies in existing MRLs, and potential mineral resources outside existing MRLs.

The SMAC's primary objective in issuing this report is to alert the Planning Commission, County Council and public of its main findings: First, that the County does not have a 50-year supply of mineral resources in existing Mineral Resource Land designations. Second, the SMAC examined alternatives for supplying additional mineral resources to meet future mineral resource demand. Third, the SMAC evaluated the Comprehensive Plan criteria for designating MRLs and recommended modifications to these criteria. Finally, the SMAC provided detailed background documentation and rationale that formed the basis for the SMAC's findings, conclusions and recommendations.

The committee finished its work and issued final recommendations on October 20, 2004. These recommendations will proceed through the Planning Commission public hearing process prior to consideration by the County Council in the fall of 2004.

It is anticipated that the committee's recommendations may be refined, revised and improved as the public, the Planning Commission and the County Council, review them. However, the work of the Surface Mining Advisory Committee represents a significant step and provides a firm base for mineral resource planning in our community.

The SMAC's Business Rules specify a consensus decision-making process. We, the undersigned members, hereby affirm that the Whatcom County SMAC gave final approval, by consensus, to the recommendations in this document on October 20, 2004, except where specifically noted that consensus was not reached.

Scott Babcock, Geologist representative

Cleo Callen, Material user representative

John Matzinger, Engineer representative (Chair)

Alvin Starkenburg, Surface mining industry representative

John Van Boven, Surface mining industry representative

Jerry Van Dellen, Agriculture/Conservation District representative

Tom Westergreen, Forestry representative

Peter Willing, Ground water representative

Section I: Projected Fifty-Year Demand and Supply of Mineral Resources in Existing MRLs

Whatcom County Comprehensive Plan GOAL 8P is to:

Designate Mineral Resource Lands (MRLs) containing commercially significant deposits throughout the county in proximity to markets in order to avoid construction aggregate shortages, higher transport costs, future land use conflicts and environmental degradation. Balance MRL designations with other competing land uses and resources.

Additionally, Policy 8P-1 is to “Designate a 50 year supply of commercially significant construction aggregate supply.”

The Surface Mining Advisory Committee (SMAC) has projected the demand for mineral resources in Whatcom County over a 50-year planning period and evaluated the supply of mineral resources in existing MRLs. The SMAC finds that the supply of mineral resources, including sand, gravel and bedrock, in existing MRLs is insufficient to meet the 50-year demand. The SMAC’s findings relating to this issue are summarized below.

Sand and Gravel

50-year Demand:	157.6 million cubic yards
Supply in existing MRLs:	60.7 million cubic yards
Deficit:	96.9 million cubic yards

Bedrock

50-year Demand:	16.8 million cubic yards
Supply in existing MRLs:	8.7 million cubic yards
Deficit:	8.1 million cubic yards

Total Mineral Resources (Sand, gravel & bedrock)

50-year Demand:	174.4 million cubic yards
Supply in existing MRLs:	69.4 million cubic yards
Deficit:	105 million cubic yards

Section II: Findings and Conclusions of the SMAC

1. **Demand** - The SMAC projects that there will be a demand for approximately 174.4 million cubic yards of mineral resources over the next 50 years in Whatcom County. This consists of a demand for about 157.6 million cubic yards of sand & gravel and 16.8 million cubic yards of bedrock.
2. **Supply** – The SMAC estimates that there is a supply of approximately 69.4 million cubic yards of mineral resources in existing MRLs. This includes a supply of about 60.7 million cubic yards of sand & gravel and 8.7 million cubic yards of bedrock.
3. **Deficit** – Theoretically, there is enough total supply in existing MRLs to satisfy demand over the first 20 years of the planning period. However, there is an imbalance in the demand and supply of sand and gravel. There is a greater need for gravel resources than sand and, as we approach the end of the 20-year planning period, we can anticipate a shortage of gravel. Additionally, shortly after the 20-year planning period, we will run out of sand and gravel resources if existing MRLs are not expanded. Over the 50-year planning period, there would be a mineral resource deficit of approximately 105 million cubic yards if additional MRLs are not designated. This includes a deficit of about 96.9 million cubic yards of sand & gravel and 8.1 million cubic yards of bedrock.
4. **Comprehensive Plan 50-year Supply Policy** – Whatcom County Comprehensive Plan Policy 8P-1 is to “Designate a 50 year supply of commercially significant construction aggregate supply.” The SMAC finds that existing MRLs do not contain a 50-year supply of such mineral resources.
5. **New MRLs outside the Agriculture Zone** – The SMAC has evaluated the potential availability of mineral resources outside of the Agriculture zoning district. The SMAC finds that there may be approximately 25.8 million cubic yards of sand & gravel deposits that could be designated for MRL status and extracted in the future. These deposits, if designated in their entirety as MRLs, would not satisfy the 96.9 million cubic yard deficit of sand & gravel materials needed to meet the 50-year demand.
6. **Evaluation of Other Alternatives** – The SMAC evaluated other alternatives to meeting the 50-year demand including conservation/recycling, river gravel, import, and crushing bedrock as a substitute for gravel.

- *Conservation/Recycling* -

An article entitled “Aspects of Growth Management Planning for Mineral Resource Lands” by William S. Lingley, Jr. of the Washington State Department of Natural Resources (*Washington Geology*, vol. 22, no. 2, July 1994, pp. 36-45), suggests that the total per capita consumption of all construction aggregates will be reduced to about 90 percent of current levels over a 20-year period. Additionally, the article suggests that for the 50-year planning period, demand may be assumed to be 80 percent of current levels. The article cites conservation, recycling, increased cost, high-density development, and political

decisions as the reasons for the lower per capita demand. However, it also acknowledges that other factors might increase demand.

The Surface Mining Advisory Committee (SMAC) recommended that Whatcom County utilize the following mineral resource demand projections for 2054:

Type of Material	Volume in Cubic Yards
Sand and Gravel	157,645,884
Bedrock	16,798,332
Total	174,444,216

The SMAC considered many factors that may increase or decrease the demand and concluded the following.

Conservation efforts and recycling may lead to reduced usage of mineral resources in certain industries. However, there are several factors that will counterbalance these conservation & recycling efforts:

- Safety – Road construction practices including wider shoulders, larger road prisms with gentler side slopes, and bike lanes will continue to be implemented to provide a safe transportation system. However, these practices utilize greater quantities of mineral resources than the narrow roads of the past.
- Environmental standards – Efforts to protect water quality, such as using additional rock in road construction will continue.
- Difficult building sites – As the “easy to develop” land in Whatcom County is built-out, sites with less suitable soils (including clay) require more mineral resources to develop.

Therefore, the SMAC does not believe that conservation & recycling will cause significant reductions in demand for mineral resources over the 50-year planning period.

- *River gravel*

The upper watershed of the Nooksack River contains geologically young and unstable landmasses, which are eroded by heavy rainfall and transported by the river system towards the sea. The transport process is most active during flood flows causing periodic pulsing movements of the eroded material downstream. As the downstream river gradient flattens, the heavier sand and rock particles are deposited in meandering, braided bars.

Geomorphic studies¹ have estimated that the Nooksack River transports about 290,000 cubic yards of bed load material per year through the Deming reach. It is further estimated

¹ Lower Nooksack River Comprehensive Flood Hazard Management Plan---Sediment Supply and Transport---KCM, February 1995

that an average of 125,000 cubic yards are annually deposited within the meandering channel.

The naturally occurring bars have historically been utilized as a source of commercial gravel. However, this practice was effectively halted in the late 1990's due to tightening of the permit process associated with the protection endangered anadromous fish runs.

Regular river gravel bar harvesting was conducted in the deposition zone immediately downstream from the Mt. Baker Highway bridge and sporadically at other locations as material was needed for specific, advantageously located construction projects. The volume of material harvested was tracked by DNR Permit. For the years between 1960 and 1987 the average annual harvest was estimated at 50,000 cubic yards. For the period between 1990 and 1993 the average annual was estimated at about 170,000 cubic yards.² There is no current harvest.

Most commercial material was found in a 10-mile reach between Deming and Lynden. River bar material here is suitable for a variety of uses including general fill, engineered fill, road base material and ready mix concrete. When used for concrete mixes, river gravel must be processed by screening and washing to remove objectionable river carried debris, clays and fine silts and to adjust the gradation to specific design requirements. Use as road base material usually requires debris removal, crushing and screening.

The acceptable practices of the past were to harvest or scalp the bars using excavators, rubber tired loaders and trucks. The activity was regulated by Shorelines Substantial Development permits issued at the County level, DOE Water Quality permits, WDFW Hydraulic Project Approvals (HPA), and Washington DNR aquatic lands lease.

In addition to the regulations listed above a Corp of Engineers 404 permit is now required which brings with it much more rigorous requirements promulgated at the national level. The National Marine Fisheries Service has developed a "National Gravel Extraction Guidance" document for use by federal agencies that review and permit river gravel extraction. This document advocates a very conservative and restrictive approach to the permitting process.

While a renewable resource of somewhere in the neighborhood of 150,000 cubic yards annually may exist in the Nooksack River channel, the restrictions imposed by the current permitting process has effectively curtailed its use. Under the most favorable conditions it is doubtful that river sources would be allowed to exceed that annual deposition rate which is small in comparison to the projected Whatcom County demand. Until the permitting restrictions are eased the river will likely yield no commercial gravel resource.

²Whatcom County Comprehensive Plan, May 1997, p. 8-19.

- *Import -*

Many places along the Pacific Coast of the U.S. do not have local sources of round aggregate, as we have had up till the present. For instance, the San Francisco Bay area is importing aggregate from as far away as British Columbia, because of the exhaustion of nearby resources and the price of "land-based" delivered aggregates from the Sacramento area has become very high. Glacier Northwest is currently shipping 4 to 6 million tons per

year out of Du Pont in Pierce County. Eighty percent of it goes by barge, some of it to Alaska. Wilder Construction and Rinker Materials import aggregate to supply their asphalt plants on the Everett waterfront. Similarly, much of the downtown Seattle area receives its aggregate via barge to multiple locations. Ash Grove has control of a vast deposit of limestone at Blubber Bay on Texada Island, B.C. in Georgia Strait. They process the rock into several products and ship to numerous locations in the B.C. Lower Mainland, Puget Sound, and beyond. This material is primarily used for cement production; general aggregate uses have proven to be difficult primarily because of the lower quality of the materials. Other sand & gravel resources in British Columbia (Sechelt area) are supplying the Vancouver market. There are very substantial sources of gravel in Alaska (Yakutat; Prince of Wales Island; Anchorage) under consideration for development, but competition has so far favored cheaper sources closer to the market.

Currently, there is one location for importing/exporting aggregate resources on the waterfront (the Whatcom Waterway). Quantities and frequency of operation are both limited. So is the probable potential for expansion.¹ The unloading operation entails spotting a barge crosswise in the waterway, and unloading by truck and loader.

Intalco operates a pier and conveyor unloading facility at Cherry Point. It moves ship-borne bauxite (aluminum ore) to the smelter on the uplands. It is currently underutilized, and likely to remain so. Widely available information points to the eventual phase-out of full-scale operations at Intalco, although it may continue at a reduced scale as a specialty operation. It is conceivable that excess capacity could be devoted to handling construction aggregate.

Examples of active aggregate handling facilities can be found nearby. One is on Granville Island in the middle of Vancouver Harbor. Another is at Du Pont, in southern Puget Sound. A third is on the Willamette River in the middle of Portland, Oregon and finally the asphalt and concrete plants in Everett. These facilities all serve large population bases.

Economically, every time material is handled, costs increase. While the material transport costs are very favorable with barging, it costs to load the barge, unload the barge, possibly stockpile, and finally load the final delivery truck. Successful “depots” have an automated stockpiling system, a large “footprint” for storage, usually a “value added” customer such as an asphalt or concrete plant which all help minimize the incremental costs of handling the materials. Also of critical concern is that these kinds of facilities need good transportation access from the water to the “market”. Even then, the cost-competitive delivered materials will only extend inland only to a point where land based resources can be trucked. For example in Snohomish County today, this line is approximately the I-5 corridor.

A shift from local aggregate sources to imported sources would be accompanied by profound shifts in the structure of the market. The trend toward vertical integration and larger operations in the aggregate business has been proceeding for some time; it would increase with import (Patrick Burden, Northern Economics). Smaller operators would be either absorbed or eliminated. Whatcom County, and perhaps the Port of Bellingham,

could be in a position to influence this situation. Both will probably have a role in providing access to shipping facility infrastructure. They could act to make this access equitable to all participants.

The consideration of barging to provide Whatcom County's future supply of construction aggregate has several implications. First and foremost is the recognition that a supply of material is not guaranteed or secured. Whatcom County will be dependent upon another jurisdiction that will control our future material supply. A shift to rely on imported product will not likely be reversed. Whatcom County will be forced to compete for product at prices and terms dictated by other jurisdictions. The revenue stream from Whatcom County will be significant.

Furthermore, barging has historically provided for processed products for onsite asphalt and concrete plants in densely populated areas. The 1 million to 1.5 million yards of common fill materials, that are expected to be used in Whatcom County annually, have not typically been provided for in this manner. Relying on barging for this material does not appear to be economically or practically feasible in the foreseeable future.

Barging, especially in the early phases of a transition to imports, is best viewed as a supplemental source of aggregate to increase the life of material available in County and should not be considered as a replacement source of our construction aggregate material.

Note on information sources: The details furnished in this memo have been provided by knowledgeable people in the barge industry, Alaska, Oregon and British Columbia governments, Intalco, Glacier Northwest, and economists with Northern Economics.

¹ The Waterfront Futures Project visioning and master planning process does not appear to make provision for this.

- *Bedrock -*

The SMAC's demand projection assumes that bedrock would start to be crushed and used as a substitute for gravel starting in 10 years. After 10 years, bedrock will substitute for 5% of the gravel demand. This figure is limited to 5% because of the relatively poor quality of bedrock materials in Whatcom County, the difficulty in substituting these materials for concrete and asphalt applications, distance to market, and the higher costs associated with processed bedrock materials. With regard to the quality of Whatcom County bedrock, the Reconnaissance Investigation of Sand, Gravel, and Quarried Bedrock Resources in the Bellingham 1:100,000 Quadrangle, Washington (DNR, Jan. 2001) states:

“Field investigations suggest that most of these bedrock units are of poor quality for aggregate . . . High quality bedrock deposits suitable for use as aggregate are scarce in the Bellingham quadrangle. . . (pp. 4 and 9).

Additionally, the Report Engineering Geology Evaluation Aggregate Resource Inventory Study Whatcom County, Washington, (GeoEngineers, Inc., Sept. 2003) states:

“Generally, the bedrock that underlies most of the study area is comprised of weak sedimentary and metamorphic rock that is not particularly suitable for aggregate use. Consequently, only a limited number of bedrock units have been successfully mined for construction aggregate in western Whatcom County. . . Construction aggregate is used for many purposes, it is difficult to use crushed bedrock and sand for some of these uses (pp. 13 and 36).

Therefore, the SMAC does not believe that substitution of crushed bedrock for aggregate will significantly increase the supply of aggregate over the 50-year planning period.

7. **MRLs in the Agriculture Zone** – Mineral Resource action plan item # 9 in the Whatcom County Comprehensive Plan includes an evaluation every seven years of “new designations in order to maintain a 50-year supply of mineral resources.” This seven-year review is being undertaken in 2004. Additionally, action item # 9 calls for a review of the MRL designation criteria. MRL designation criteria 11 and 12 relate to whether or not MRLs should be allowed in designated Agricultural areas. Specifically, criterion # 12 contemplates that a study would be done within five years of original adoption of the Comprehensive Plan. The Comprehensive Plan was adopted in 1997, and the study was due in 2002. In fact, the study was completed in 2003 by Geo-Engineers, Inc. MRL designation criterion 12 also states, among other things:

. . . The County shall draft, adopt and implement all legislation necessary to allow or disallow mineral resource extraction in all or some prime farmlands, under the parameters listed below.

Upon conclusive demonstration through the [Comprehensive Construction Aggregate Study] CCAS study of a shortage of commercially significant quality aggregate resources in Whatcom County outside of designated agricultural areas, and an overriding need to mine aggregate in designated agricultural lands as opposed to other viable alternatives, the County shall allow site application for AG/MRL designation . . .

The SMAC, in carrying out its function set forth in Whatcom County Code 2.120.030 to address the action items of the mineral resources element of the Whatcom County Comprehensive Plan, finds that one of those action items is to evaluate both the 50-year supply of minerals and the MRL designation criteria, which specifically indicates that the County will make a determination of whether or not MRLs should be allowed in designated Agriculture areas. Therefore, the SMAC finds that its role includes making recommendations relating to whether MRL designations should be considered in Agricultural areas.

SMAC believes there will be a shortage of mineral aggregate over the planning period. To address this situation SMAC recommends a broader stewardship approach to balancing the supply/demand relationship. To that end, SMAC recommends the County further explore the development of potential for imported supply and the consideration of designating MRLs in agricultural lands.

8. **Strategy for Increasing Supply** – The SMAC’s 2004 Work Plan contained the following goal: “If it is determined that Whatcom County does not have a 50-year supply, recommend strategies for achieving this supply.” The SMAC considered whether the strategy should:

- Encourage private operators/land owners to apply for MRLs; and/or
- Consist of County designation of MRLs without an application from a private party.

The SMAC decided that neither of these options were appropriate. Rather, the SMAC recommended an educational approach to let the public know that there is a projected shortage of mineral resources and provide information where mineral resources are generally located. This educational approach could consist of maps, brochures, and fact-sheets made available to the public, information on the Internet and/or press releases. Individual property owners and/or mining businesses would make the choice of whether to apply for an MRL in a given location. In the event additional designations of appropriate material were not forthcoming, Whatcom County should re-evaluate this approach.

9. **MRL Designation Criteria** – The SMAC is recommending modifications to the Whatcom County Comprehensive Plan’s criteria for designating new MRLs as shown in section III of this report.

10. **Depleted MRLs** – The SMAC recommends that a process be developed for the removal of depleted sites from the MRL designation. Otherwise, sites may continue to be in the MRL after they are no longer active extraction or processing sites.

Section III: Comprehensive Plan Amendments

The Surface Mining Advisory Committee recommends amending the MRL designation criteria in chapter 8 of the Whatcom County Comprehensive Plan as follows (new language is shown with underlining and language proposed to be deleted is shown with strike-throughs):

I. Non-Metallic Mineral Deposits

General Criteria

1. Non-metallic deposits must contain at least 400,000 ~~one million~~ cubic yards of proven and extractable sand, gravel, or rock material per new MRL Designation.

The SMAC's Business Rules specify a process of decision making by consensus. The above amendment was proposed but consensus was not reached.

The rationale FOR the proposed amendment is as follows: The SMAC is projecting a shortage of mineral resources over the 50-year planning period. It is important to protect smaller mineral resource deposits before development near or over them makes it difficult or impossible to extract these minerals. It is often unrealistic to expect to have a resource of 1,000,000 cubic yards of sand and gravel on a 20-acre parcel.

The rationale AGAINST the proposed amendment is as follows: The Committee has not generated or seen information about specific parcels where the necessity for and the effect of this change could be examined. In addition, there is a concern over proliferation of new small geographically separated MRLs.

2. Minimum MRL Designation size is twenty acres.
3. Expansion of an existing MRL does not need to meet criteria 1 or 2.

Rationale for proposed amendment: The SMAC is projecting a shortage of mineral resources over the 50-year planning period. It is important to protect smaller mineral resource deposits before development near or over them makes it difficult or impossible to extract these minerals. Extraction of mineral deposits near existing mining operations will generally reduce impacts when compared to starting up a new mining operation where mining has not occurred before.

4. MRL Designation status does not apply to surface mines permitted as an accessory or conditional use for the purpose of enhancing agriculture or facilitating forestry resource operations.
5. All pre-existing legal permitted sites meeting the above criteria will be designated.

6. ~~Greater than 75% of the site must be classified as MRA 2 (see Map 21) and have proven resource, or meet the following criteria:~~ The site shall have a proven resource that meets the following criteria:

- Construction material must meet WSDOT Standard Specifications for common borrow criteria for road, bridge and municipal construction, or Whatcom County standards for other uses.
- Sand and gravel deposits must have a net to gross ratio greater than 80% (1290 cy/acre/foot).

Rationale for proposed amendment: The MRA-2 areas were largely based upon surficial mapping. In order for a site to be designated as an MRL an applicant should prove that it has quality mineral resources through excavation (or drilling) and lab testing. If such testing is performed, it should not matter whether the site was on the MRA-2 map. The purpose of this criterion is to confirm that the site has quality mineral resources, and sampling materials from the site is the appropriate method of determining the quality of these minerals.

7. MRL Designations must not be within or adjacent to developed residential zones or subdivisions platted at urban densities, unless project specific mitigation is created.

The SMAC's Business Rules specify a process of decision making by consensus. The above amendment was proposed but consensus was not reached.

The rationale FOR the proposed amendment is as follows: There may be cases where a buffer, berm, existing trees, and/or plantings would sufficiently screen a mining operation from an adjacent residential area. Therefore, a site should not automatically be eliminated from consideration as an MRL because it is adjacent to a residential zoning district or urban density subdivision.

The rationale AGAINST the proposed amendment is as follows: Relaxing the terms controlling the proximity with which new MRLs may approach residential areas is a recipe for land use conflicts, which is one of the things we are trying to avoid. We decided no standard for what would constitute "project specific mitigation."

8. MRL Designations must not occur within the 5 year zone of contribution for designated wellhead protection areas, as approved by Whatcom County, provided that designations within the 10 year zone of contribution shall not subsequently allow mining within 10 vertical feet of the seasonal high water table. MRL designations may be modified if a wellhead protection area delineated subsequent to MRL designation encompasses areas within a designated MRL.

OR

MRL Designations must not occur within the 10 ~~5~~ year zone of contribution for designated wellhead protection areas, as approved by State Department of Health in accordance with source control provisions of Department of Health regulations on water system comprehensive planning ~~Whatcom County, provided that designations within the 10-year zone of contribution shall not subsequently allow mining within 10 vertical feet of the seasonal high water table.~~ MRL designations may be modified if a wellhead protection area delineated subsequent to MRL designation encompasses areas within a designated MRL.

The SMAC's Business Rules specify a process of decision making by consensus. The above amendment was proposed but consensus was not reached.

Rationale to keep the existing language: Following extensive public comment and the review of the scientific information presented, the Whatcom County Council selected this language in 1997 as providing appropriate protection for water quality.

The restriction selected was based on Wellhead Protection Program guidelines that discuss the purpose and function of the various zones of protection, i.e., the sanitary control area, and the one, five and ten-year horizontal times of travel. These Department of Health guidelines recommend the exclusion of medium risk and high risk activities within the ten year time of travel boundary.

In 1996, Associated Earth Sciences, Inc. was directly asked by the City of Everson to assess the risk of gravel mining within the City's well field. The report prepared, dated July 8, 1996, concluded that there is a relatively low risk to water quality from gravel extraction activities, especially if the mining occurs above the water table. (See also a report entitled "The Direct and Cumulative Effects of Gravel Mining on Ground Water Within Thurston County, Washington," 1995).

Whatcom County Comprehensive Plan Policy 8K-3 is to:

Avoid adversely impacting water quality. The protection of aquifers and recharge zones should have precedence over surface mining in the event it is determined by the county that adverse impacts cannot be avoided through the standard use of best management practices. Avoid contamination of aquifers by using uncontaminated material for reclamation or on-site storage.

No hard evidence has been submitted that mining in the 10-year wellhead protection areas has caused contamination of drinking water. In addition, no information has been developed or submitted that contradicts the information researched and reviewed in 1997.

In fact, in other States mining takes place within wellhead areas to provide enhancement for the water system and supply. Also, mining has historically taken place within the Nooksack River, which provides the water supply for a large portion of our County population.

The State Department of Ecology (DOE) administers provisions of The State of Washington Water Pollution Control Law (RCW 90.48) and provisions of The Federal Water Pollution

Control Act (Clean Water Act). In this capacity, Ecology approves mining operations under “The Sand and Gravel General Permit.” This Permit is aimed at protecting water quality.

Prohibiting surface mining within the 10 year TOT would reduce the area available for potential resource exploitation by approximately 2,760 acres. This represents the acres within the Potential Resource Areas or PRAs that are also within the 10-year wellhead protection area (this figure excludes areas occupied by pipelines, streams, wetlands, and their buffers and existing MRLs). The artificial constraint does not allow for site-specific operational standards to be applied. In fact there are many geologic conditions (e.g. underlying aquicludes) and some operational procedures (e.g. washing of fines in the pit) that would protect aquifers even within the 5 year TOT.

Rationale to change the existing language: Ground water dependent public water systems have substantial investments in their infrastructure and in many cases have no alternative water supplies available to them. They are consequently disinclined to accept any increased risk of contamination to their aquifer that may result from mineral extraction. They are mindful that surface mining opens a window to the aquifer that increases risk of groundwater contamination.

9. MRL Designation should not enclose by more than 50% non-designated parcels.

Additional Criteria for Designated Urban and Rural Areas

10. Abutting parcel size density must not exceed one unit per nominal five acres for more than 25% of the perimeter of the site, unless project specific mitigation is created.

Additional Criteria for Designated Forestry Areas

11. Must demonstrate higher value as mineral resource than forestry resource based upon:

- soil conditions
- accessibility to market
- quality of mineral resource
- sustainable productivity of forest resource

Additional Criteria for Designated Agricultural Areas

12. MRL Designations shall not be located within designated Agricultural lands that contain Prime Agricultural Soils until:

- The Agricultural Advisory Committee drafts proposed MRL designation criteria and related zoning regulations;
- The Surface Mining Advisory Committee comments on the draft criteria and regulations;
- The criteria and regulations are reviewed by the Planning Commission; and
- The criteria and regulations are adopted by the County Council.

These criteria and regulations will be drafted, reviewed and adopted by the end of 2005.

~~MRL Designations shall not be located within a Prime Farmland Soil Area unless the property is located adjacent to a MRL site and will align the configuration of the MRL.~~

13. The criteria referenced in # 12 above will address the following factors:

- a. quality and quantity of the mineral resource
- b. quality of the agricultural resource
- c. soil and site restoration potential
- d. predominant surrounding uses
- e. potential effects on nearby farming operations
- f. potential effects on other natural resources and systems
- g. resource availability in the county.

MRL designations will not be allowed pursuant to # 12 above if the County has a 50-year supply of mineral resources in existing MRLs. Mining permit applications within designated MRLs approved pursuant to #12 above will be reviewed through a conditional use permit process that requires restoration to productive agricultural capacities comparable to previous levels or mitigation to compensate for impacted Prime Agricultural Soils. The Whatcom Conservation District will be consulted in the MRL Designation and conditional use permit process.

~~Additional lands which do not meet the above criteria (#11) but which contain quality mineral resources may be identified as an AG/MRL study area for no more than five years from the date of adoption of this plan. Within the five years, during the data collections and review period, the County shall budget, initiate and complete a Comprehensive Construction Aggregate Study (CCAS) documenting the short and long range availability of commercially significant construction quality aggregate resources in Whatcom County. The CCAS study shall be publicly reviewed and approved by the County Council. The County shall draft, adopt and implement all legislation necessary to allow or disallow mineral resource extraction in all or some prime farmlands, under the parameters listed below.~~

~~Upon conclusive demonstration through the CCAS study of a shortage of commercially significant quality aggregate resources in Whatcom County outside of designated agricultural areas, and an overriding need to mine aggregate in designated agricultural lands as opposed to other viable alternatives, the County shall allow site application for AG/MRL designation. Individual sites may be designated as AG/MRL if the applicant can clearly demonstrate that the estimated extraction activity would be in the best interests of the County based upon the below parameters:~~

- a. ~~quality of the mineral resource~~
- b. ~~quality of the agricultural resource~~
- c. ~~soil and site restoration potential~~
- d. ~~predominant surrounding uses~~
- e. ~~potential effects on nearby farming operations~~

- f. ~~potential effects to other natural resources and systems.~~
- g. ~~resource availability in the county.~~

~~Mining permit applications within designated sites approved under Criterion #12 shall be reviewed through a local discretionary permitting process that maintains local jurisdiction over reclamation, and requires restoration to productive agricultural capacities comparable to previous levels. The Whatcom Conservation District shall be consulted in the permitting process.~~

II. River and Stream Gravel

- 14. MRL Designation status applies to river gravel bars possessing necessary permits and containing significant quality reserves.
- 15. MRL Designation status may apply to those upland sites located in proximity to river gravel sources and used primarily for handling and processing significant amounts of river gravel.

III. Metallic and Industrial Mineral Deposits

- 16. For metallic and rare minerals, mineral designation status extends to all patented mining claims.
- 17. Mineral Resource Designation status extends to all currently permitted industrial mineral deposits of long-term commercial significance.
- 18. All other non-patented mineral deposits must meet the non-metallic MRL Designation criteria, numbers 6 through 12, as applicable.

MINERAL RESOURCES - SITE SELECTION METHOD

- 1. Sites meeting Mineral Resources Designation Criteria 1-5 ~~1-4~~ (and areas enclosed by these sites greater than 50%).
- 2. Sites requested by owner or operator meeting designation criteria.
- 3. Sites that are regionally significant meeting designation criteria.
- 4. Sites adjacent to both roads and other proposed MRL sites meeting designation criteria.

Section IV: Appendices

A Note About Appendices A, B and C

Appendices A, B and C contain the findings of the Whatcom County Surface Mining Advisory Committee. The findings in Appendices A, B and C are intended to document the committee's evaluation of mineral resource issues and are translated into specific recommendations for action in other parts of this report. The committee's findings are contained in three appendices:

- ✓ Appendix A - Mineral Resource Demand Projection for 2054. This appendix contains mineral resource demand projections for the 50-year planning period between 2005 and 2054. It also breaks these demand projections down into two categories: sand/gravel and bedrock. Finally, this appendix provides the rationale employed by the SMAC to project demand.
- ✓ Appendix B - Mineral Resource Supplies in Existing MRLs. This appendix contains the estimated supply of mineral resources in existing MRLs. It breaks supply down into two categories: sand/gravel and bedrock. The appendix also reiterates the demand (from Appendix A) so that the surplus or deficit of mineral resources over a 20-year period and 50-year period can be ascertained.
- ✓ Appendix C - Potential Mineral Resources Outside Existing MRLs. This appendix contains the SMAC's evaluation of mineral resources in the "potential resource areas" identified in the Geo-Engineer's report (Sept. 2003). The SMAC utilized GIS mapping and data, along with knowledge/expertise of committee members to estimate the volume of material that may be available in potential resource areas that are not currently designated as MRLs.

APPENDIX A

Mineral Resource Demand Projection for 2054

The Surface Mining Advisory Committee (SMAC) recommends that Whatcom County utilize the following mineral resource demand projections for 2054:

Type of Material	Volume in Cubic Yards
Sand and Gravel	157,645,884
Bedrock	16,798,332
Total	174,444,216

Cubic Yards/Capita

These projections are derived utilizing 12.2 cubic yards/capita of sand and gravel and 1.3 cubic yards/capita of bedrock to evaluate the 50-year demand, which were employed for the following reasons:

1. These ratios were utilized in the 1997 Whatcom County Comprehensive Plan. Using these same ratios in the 2004 Comprehensive Plan update will provide continuity and consistency in our mineral resource planning efforts.
2. Conservation efforts and recycling may lead to reduced usage of mineral resources in certain industries. However, there are several factors that will counterbalance these conservation & recycling efforts:
 - Safety – Road construction practices including wider shoulders, larger road prisms with gentler side slopes, and bike lanes will continue to be implemented to provide a safe transportation system. However, these practices utilize greater quantities of mineral resources than the narrow roads of the past.
 - Environmental standards – Efforts to protect water quality, such as using additional rock in road construction will continue.
 - Difficult building sites – As the “easy to develop” land in Whatcom County is built-out, sites with less suitable soils (including clay) require more mineral resources to develop.
3. Projecting anticipated mineral resource demand over a 50-year period requires assumptions that may not materialize. It is better to err on the side of providing a larger mineral resource supply than to err on the side of providing a smaller mineral resource supply.

4. Planning risks associated with providing too small of a supply include running out of mineral resources prior to the 50-year planning period.
5. Whatcom County is anticipated to grow by more than 62,000 people over the next 20 years. If adequate long-term supplies are not designated, construction may occur over these supplies rendering them inaccessible in the future.
6. Deferring the process of designating adequate mineral supplies may give people moving into an area that contains quality mineral resources a sense that no mining will occur in the area. Subsequent designation of MRLs may lead to additional conflicts.
7. Designation of adequate supplies now will reduce (but certainly not eliminate) conflicts in the long run and will alert future property owners to the possibility of mining in the area.

Population Projections

The population projections for Whatcom County utilized in calculating the 50-year mineral resource demand projections are based on the following:

1. The 2002 population is the state Office of Financial Management estimate, which is utilized in Chapter 1 of the Whatcom County Comprehensive Plan.
2. The 2022 population projection is the projection approved by the County Council in 2004 and is contained in Chapter 1 of the Whatcom County Comprehensive Plan.
3. The 2054 projection assumes absolute annual population growth between 2022 and 2054 will be the same as annual average population growth between 2002 & 2022 as approved by the County Council in 2004 (annual increase of 3,135.85 people per year).

Yearly Totals

The 2054 demand projection is based upon the accumulation of yearly demand shown in the spreadsheet on the following page.

Year	Population	Sand & Gravel Demand in cubic yards each year	Cumulative Sand & Gravel Demand in cubic yards	Bedrock Demand in cubic yards each year	Cumulative Bedrock Demand in cubic yard	Total Demand in cubic yards each year	Cumulative Demand in cubic yards
2002	172,200						
2003	175,336						
2004	178,472						
2005	181,608	2,215,612	2,215,612	236,090	236,090	2,451,702	2,451,702
2006	184,743	2,253,869	4,469,482	240,166	476,256	2,494,036	4,945,738
2007	187,879	2,292,127	6,761,608	244,243	720,499	2,536,370	7,482,108
2008	191,015	2,330,384	9,091,993	248,320	968,819	2,578,704	10,060,812
2009	194,151	2,368,642	11,460,634	252,396	1,221,215	2,621,038	12,681,849
2010	197,287	2,406,899	13,867,533	256,473	1,477,688	2,663,372	15,345,221
2011	200,423	2,445,156	16,312,690	260,549	1,738,237	2,705,706	18,050,927
2012	203,559	2,483,414	18,796,103	264,626	2,002,863	2,748,040	20,798,967
2013	206,694	2,521,671	21,317,774	268,703	2,271,566	2,790,374	23,589,340
2014	209,830	2,559,928	23,877,703	272,779	2,544,345	2,832,708	26,422,048
2015	212,966	2,598,186	26,475,889	276,856	2,821,201	2,875,042	29,297,090
2016	216,102	2,636,443	29,112,332	280,932	3,102,134	2,917,376	32,214,465
2017	219,238	2,674,701	31,787,032	285,009	3,387,143	2,959,710	35,174,175
2018	222,374	2,712,958	34,499,990	289,086	3,676,228	3,002,044	38,176,219
2019	225,509	2,751,215	37,251,206	293,162	3,969,391	3,044,378	41,220,596
2020	228,645	2,789,473	40,040,678	297,239	4,266,630	3,086,712	44,307,308
2021	231,781	2,827,730	42,868,408	301,315	4,567,945	3,129,046	47,436,353
2022	234,917	2,865,987	45,734,396	305,392	4,873,337	3,171,380	50,607,733
2023	238,053	2,904,245	48,638,640	309,469	5,182,806	3,213,713	53,821,446
2024	241,189	2,942,502	51,581,143	313,545	5,496,351	3,256,047	57,077,494
2025	244,325	2,980,760	54,561,902	317,622	5,813,973	3,298,381	60,375,875
2026	247,460	3,019,017	57,580,919	321,699	6,135,672	3,340,715	63,716,591
2027	250,596	3,057,274	60,638,193	325,775	6,461,447	3,383,049	67,099,640
2028	253,732	3,095,532	63,733,725	329,852	6,791,299	3,425,383	70,525,023
2029	256,868	3,133,789	66,867,514	333,928	7,125,227	3,467,717	73,992,741
2030	260,004	3,172,046	70,039,560	338,005	7,463,232	3,510,051	77,502,792
2031	263,140	3,210,304	73,249,864	342,082	7,805,313	3,552,385	81,055,177
2032	266,276	3,248,561	76,498,425	346,158	8,151,472	3,594,719	84,649,896
2033	269,411	3,286,818	79,785,243	350,235	8,501,706	3,637,053	88,286,950
2034	272,547	3,325,076	83,110,319	354,311	8,856,018	3,679,387	91,966,337
2035	275,683	3,363,333	86,473,652	358,388	9,214,406	3,721,721	95,688,058
2036	278,819	3,401,591	89,875,243	362,465	9,576,870	3,764,055	99,452,113
2037	281,955	3,439,848	93,315,091	366,541	9,943,411	3,806,389	103,258,502
2038	285,091	3,478,105	96,793,196	370,618	10,314,029	3,848,723	107,107,225
2039	288,226	3,516,363	100,309,559	374,694	10,688,724	3,891,057	110,998,283
2040	291,362	3,554,620	103,864,179	378,771	11,067,494	3,933,391	114,931,674
2041	294,498	3,592,877	107,457,056	382,848	11,450,342	3,975,725	118,907,399
2042	297,634	3,631,135	111,088,191	386,924	11,837,266	4,018,059	122,925,458
2043	300,770	3,669,392	114,757,583	391,001	12,228,267	4,060,393	126,985,851
2044	303,906	3,707,650	118,465,233	395,077	12,623,345	4,102,727	131,088,578
2045	307,042	3,745,907	122,211,140	399,154	13,022,499	4,145,061	135,233,638
2046	310,177	3,784,164	125,995,304	403,231	13,425,729	4,187,395	139,421,033
2047	313,313	3,822,422	129,817,726	407,307	13,833,036	4,229,729	143,650,762
2048	316,449	3,860,679	133,678,405	411,384	14,244,420	4,272,063	147,922,825
2049	319,585	3,898,936	137,577,341	415,460	14,659,881	4,314,397	152,237,222
2050	322,721	3,937,194	141,514,535	419,537	15,079,418	4,356,731	156,593,953
2051	325,857	3,975,451	145,489,986	423,614	15,503,031	4,399,065	160,993,017
2052	328,993	4,013,709	149,503,695	427,690	15,930,722	4,441,399	165,434,416
2053	332,128	4,051,966	153,555,661	431,767	16,362,488	4,483,733	169,918,149
2054	335,264	4,090,223	157,645,884	435,843	16,798,332	4,526,067	174,444,216

GRAND TOTAL

157,645,884

16,798,332

174,444,216

APPENDIX B

Mineral Resource Supplies in Existing MRLs

**Short-term supply 2005-2024
(1st 20 years of the 50-year planning period)**

	Sand/gravel	Bedrock	Total
	cubic yards	cubic yards	cubic yards
Supply 2005-2024	59,305,172	10,114,828	69,420,000
Demand 2005-2024	51,581,143	5,496,351	57,077,494
Surplus/(Deficit)	7,724,029	4,618,477	12,342,506

Notes

1. Supply of sand/gravel in the chart above is calculated as follows:

29,600,000	Total measured sand & gravel reserves
+ 30,120,000	60% of Total indicated/inferred sand & gravel reserves
- 1,800,000	Sand & gravel reserves used in 2004
+ <u>1,385,172</u>	Crushed bedrock used as a substitute for gravel 2015-2024
59,305,172	Total Supply (2005-2024)

2. Supply of bedrock in the chart above is calculated as follows:

26,500,000	Total measured bedrock reserves
+ 9,400,000	Total indicated/inferred bedrock reserves
- 24,200,000	Tilbury MRL-22
- 200,000	Bedrock reserves used in 2004
- <u>1,385,172</u>	Crushed bedrock used as a substitute for gravel 2015-2024
10,114,828	Total Supply (2005-2024)

**Long-term supply 2025-2054
(Last 30 years of the 50-year planning period)**

	Sand/gravel	Bedrock	Total
	cubic yards	cubic yards	cubic yards
Supply 2025-2054	9,134,234	3,208,272	12,342,506
Demand 2025-2054	106,064,741	11,301,981	117,366,722
Surplus/(Deficit)	(96,930,507)	(8,093,709)	(105,024,216)

Notes

1. Supply of sand/gravel in the chart above is calculated as follows:

	29,600,000	Total measured sand & gravel reserves
+	30,120,000	60% of Total indicated/inferred sand & gravel reserves
-	1,800,000	Sand & gravel reserves used in 2004
-	50,195,971	Sand & reserves used in 2005-2024 (Demand - crushed bedrock substituted)
+	<u>1,410,205</u>	Crushed bedrock used as a substitute for gravel 2025-2033
	9,134,234	Total Supply (2025-2054)

2. Supply of bedrock in the chart above is calculated as follows:

	26,500,000	Total measured bedrock reserves
+	9,400,000	Total indicated/inferred bedrock reserves
-	24,200,000	Tilbury MRL-22
-	200,000	Bedrock reserves used in 2004
-	5,496,351	Bedrock reserves used in 2005-2024
-	1,385,172	Crushed bedrock used as a substitute for gravel 2015-2024
-	<u>1,410,205</u>	Crushed bedrock used as a substitute for gravel 2025-2054
	3,208,272	Total Supply (2025-2054)

**Total Mineral Resource Supply 2005-2054
(Entire 50-year Planning Period)**

	Sand/gravel	Bedrock	Total
	cubic yards	cubic yards	cubic yards
Supply 2005-2054	60,715,377	8,704,623	69,420,000
Demand 2005-2054	157,645,884	16,798,332	174,444,216
Surplus/(Deficit)	(96,930,507)	(8,093,709)	(105,024,216)

Notes

1. Supply of sand/gravel in the chart above is calculated as follows:

	29,600,000	Total Measured Reserves
+	30,120,000	60% of Total Indicated/Inferred Reserves
-	1,800,000	Reserves used in 2004
+	<u>2,795,377</u>	Crushed bedrock used as a substitute for gravel 2015-2033
	60,715,377	Total Supply (2005-2054)

2. Supply of bedrock in the chart above is calculated as follows:

	26,500,000	Total Measured Reserves
+	9,400,000	Total Indicated/Inferred Reserves
-	24,200,000	Tilbury MRL-22
-	200,000	Reserves used in 2004
-	<u>2,795,377</u>	Crushed bedrock used as a substitute for gravel 2015-2033
	8,704,623	Total Supply (2005-2054)

Surface Mining Advisory Committee Assumptions/Methods

1. Break 50-year supply into short-term supply (1st 20 years of the 50-year planning period) and long-term supply (last 30 years of the 50-year planning period).
2. The 50-year supply of sand and gravel includes 100% of the “measured” reserves from the Report Engineering Geology Evaluation Aggregate Resource Inventory Study Whatcom County, Washington (Geo-Engineers, Sept. 2003, p. 34, herein after referred to as the “Geo-Engineers report”). Measured reserves consist of permitted reserves in existing MRLs (Geo-Engineers report, pp. 33-34).
3. The 50-year supply of sand and gravel also includes 60% of the “indicated/inferred” reserves from the Geo-Engineers report (p. 34), which is assumed to be available as soon as needed. Indicated/inferred reserves consist of unpermitted reserves in existing MRLs (Geo-Engineers report, p. 34). The SMAC recommends deducting 40% from the indicted/inferred reserves set forth in the Geo-Engineers report for the following reasons:
 - A. Wellhead Protection Areas - Geo-Engineers subtracted out mineral resources in the 5-year wellhead protection areas from their volume calculations (p. 2). However, the Whatcom County Zoning Ordinance also prohibits the removal of sand and gravel below the water table and within 10’ above the water table in 10-year wellhead protection areas (WCC 20.73.130(2)). Geo-Engineers did not subtract this material from their volume calculations, but it will not be available under the provision of the zoning ordinance.
 - B. Pipelines – Pipeline buffers will render some of the material unavailable.
 - C. Streams & Wetlands - Streams and wetlands, along with the associated buffers imposed under the Critical Areas Ordinance, will render some of the material unavailable.

According to GIS analysis, approximately 17% of the existing sand and gravel MRLs are constrained by 10-year wellhead protection areas, pipelines, wetlands, streams and their buffers. However, there are other factors that also constrain the ability to access and utilize the reserves, as shown below.

- D. Quantity/Quality – The quantity and quality of sand & gravel deposits in the indicated/inferred category are uncertain. There has not been extensive drilling to identify the quantity of this subsurface resource nor extensive lab testing to verify that the quality meets standard specifications. In fact, the Geo-Engineers report states:

“It should be noted that the estimates of identified reserves in the aggregate MRLs are likely conservatively high for the following reasons . . .

- Measured reserves have a higher certainty of being available for use than indicated/inferred reserves due to their current permitted status.
- Portions of many MRLs were initially designated as mineral resource lands based on data that was limited in nature and likely not of sufficient quality or quantity to be categorized as “indicated” or “inferred” resources. . .” (pp. 35-36).

E. On-site Land Uses – Some MRLs have existing buildings on the site that may render a portion of the material unavailable. Additionally, some owners of land within MRL’s may not want a surface mine on their property.

F. Off-site Land Uses – Neighborhood opposition can result in increased buffers from surrounding residential uses to reduce impacts from mining, thereby rendering a portion of the minerals unavailable for mining.

The Geo-Engineers report already subtracted the volume of material lost to setbacks & reclamation slope requirements (p. B-1).

4. The 50-year supply of bedrock includes 100% of the “measured” and “indicated/inferred” reserves from the Geo-Engineers report (p. 35), except that the Tilbury MRL has been excluded. The Tilbury MRL (MRL –22) was deemed to contain poor quality bedrock. Therefore, it was excluded from the supply figures recommended by the SMAC. All other bedrock MRLs were accepted at 100% of the figures shown in the Geo-Engineers report.
5. Bedrock would start to be crushed and used as a substitute for gravel starting in 10 years. After 10 years, bedrock will substitute for 5% of the gravel demand. This figure is limited to 5% because of the relatively poor quality of bedrock materials in Whatcom County, the difficulty in substituting these materials for concrete and asphalt applications, distance to market, and the higher costs associated with processed bedrock materials. With regard to the quality of Whatcom County bedrock, the Reconnaissance Investigation of Sand, Gravel, and Quarried Bedrock Resources in the Bellingham 1:100,000 Quadrangle, Washington (DNR, Jan. 2001) states:

“Field investigations suggest that most of these bedrock units are of poor quality for aggregate . . . High quality bedrock deposits suitable for use as aggregate are scarce in the Bellingham quadrangle. . . (pp. 4 and 9).

Additionally, the Report Engineering Geology Evaluation Aggregate Resource Inventory Study Whatcom County, Washington, (GeoEngineers, Inc., Sept. 2003) states:

“Generally, the bedrock that underlies most of the study area is comprised of weak sedimentary and metamorphic rock that is not particularly suitable for aggregate use. Consequently, only a limited number of bedrock units have been successfully mined for construction aggregate in western Whatcom County. . . Construction aggregate is used

for many purposes, it is difficult to use crushed bedrock and sand for some of these uses (pp. 13 and 36).

6. Annual sand and gravel demand is assumed to be 12.2 cubic yards per capita and annual bedrock demand is assumed to be 1.3 cubic yards per capita (consistent with the method in the 1997 Whatcom County Comprehensive Plan, p. 8-18).
7. The Geo-Engineers report estimates current annual use of sand, gravel and bedrock at 1.7 to 2.2 million cubic yards/year (p. 8). It is assumed that 2,000,000 cubic yards of sand/gravel and bedrock were consumed in 2004 (between the 2003 Geo-Engineers report and the 1st year of the 50-year planning period). The 2004 consumption of 2,000,000 cubic yards was assumed to be about 1,800,000 sand/gravel and about 200,000 yards of bedrock based upon the consumption ratios in # 6 above.
8. The yardage reported is a prediction based on potential extractable material without distinguishing between the sand and gravel content and without providing the grade of the material. The yardage reported is undoubtedly greater than the actual available yardage of construction quality aggregate.

APPENDIX C

Potential Mineral Resources Outside of Existing MRLs

PRA-6 Judson-Pangborn - High Priority

	Acres	Percent	Volume Sand & Gravel
Total of PRA*	6895		
Ag zone	6883	99.8%	74,869,471
Constrained (outside Ag zone)**	12	0.2%	130,529
Unconstrained (outside Ag zone)	0	0.0%	0
		Total	75,000,000
Average lot size in unconstrained	N/A		

PRA-7 Trapline-Pangborn - High Priority

	Acres	Percent	Volume Sand & Gravel
Total of PRA*	496		
Ag zone	377	76.0%	14,821,573
Constrained (outside Ag zone)**	88	17.7%	3,459,677
Unconstrained (outside Ag zone)	31	6.3%	1,218,750
		Total	19,500,000
Average lot size in unconstrained	31***		

PRA-9 Telegraph Rd-Brandorf - High Priority

	Acres	Percent	Volume Sand & Gravel
Total of PRA*	254		
Ag zone	0	0.0%	0
Constrained (outside Ag zone)**	107	42.1%	6,529,528
Unconstrained (outside Ag zone)	147	57.9%	8,970,472
		Total	15,500,000
Average lot size in unconstrained	2.5		

PRA-8 NE Nooksack - Medium Priority

	Acres	Percent	Volume Sand & Gravel
Total of PRA*	1110		
Ag zone	1110	100.0%	5,400,000
Constrained (outside Ag zone)**	0	0.0%	0
Unconstrained (outside Ag zone)	0	0.0%	0
		Total	5,400,000
Average lot size in unconstrained	N/A		

PRA-10 Carl Road - Medium Priority

	Acres	Percent	Volume Sand & Gravel
Total of PRA*	357		
Ag zone	8	2.2%	85,154
Constrained (outside Ag zone)**	39	10.9%	415,126
Unconstrained (outside Ag zone)	310	86.8%	3,299,720
		Total	3,800,000
Average lot size in unconstrained	5.1		

PRA-13 Pole Road - Medium Priority

	Acres	Percent	Volume Sand & Gravel
Total of PRA*	1554		
Ag zone	317	20.4%	5,283,333
Constrained (outside Ag zone)**	632	40.7%	10,533,333
Unconstrained (outside Ag zone)	605	38.9%	10,083,333
		Total	25,900,000
Average lot size in unconstrained	6.7		

PRA-15 South Kendall-Nooksack River - Medium Priority

	Acres	Percent	Volume Sand & Gravel
Total of PRA*	1879		
Ag zone	0	0.0%	0
Constrained (outside Ag zone)**	1369	72.9%	26,957,424
Unconstrained (outside Ag zone)	510	27.1%	10,042,576
		Total	37,000,000
Average lot size in unconstrained	5.2		

PRA-16 Deming-Nooksack River - Medium Priority

	Acres	Percent	Volume Sand & Gravel
Total of PRA*	4256		
Ag zone	3060	71.9%	45,583,647
Constrained (outside Ag zone)**	324	7.6%	4,826,504
Unconstrained (outside Ag zone)	872	20.5%	12,989,850
		Total	63,400,000
Average lot size in unconstrained	4.7		

PRA-1 Blaine-Boundary Uplands - Low Priority

	Acres	Percent	Volume Sand & Gravel
Total of PRA*	1271		
Ag zone	0	0.0%	0
Constrained (outside Ag zone)**	557	43.8%	35,102,832
Unconstrained (outside Ag zone)	714	56.2%	44,997,168
		Total	80,100,000
Average lot size in unconstrained	9.6		

PRA-2 Grandview - Low Priority

	Acres	Percent	Volume Sand & Gravel
Total of PRA*	2663		
Ag zone	320	12.0%	20,067,593
Constrained (outside Ag zone)**	500	18.8%	31,355,614
Unconstrained (outside Ag zone)	1843	69.2%	115,576,793
		Total	167,000,000
Average lot size in unconstrained	5.3		

PRA-3 Dakota Creek-Lynden - Low Priority

	Acres	Percent	Volume Sand & Gravel
Total of PRA*	14092		
Ag zone	9635	68.4%	427,462,532
Constrained (outside Ag zone)**	995	7.1%	44,143,770
Unconstrained (outside Ag zone)	3462	24.6%	153,593,699
		Total	625,200,000
Average lot size in unconstrained	5.2		

PRA-4 Smith Road - Low Priority

	Acres	Percent	Volume Sand & Gravel
Total of PRA*	625		
Ag zone	0	0.0%	0
Constrained (outside Ag zone)**	411	65.8%	30,249,600
Unconstrained (outside Ag zone)	214	34.2%	15,750,400
		Total	46,000,000
Average lot size in unconstrained	5.7		

PRA-5 Wisner Lake - Low Priority

	Acres	Percent	Volume Sand & Gravel
Total of PRA*	5837		
Ag zone	3927	67.3%	1,210,999
Constrained (outside Ag zone)**	707	12.1%	218,023
Unconstrained (outside Ag zone)	1203	20.6%	370,978
		Total	1,800,000
Average lot size in unconstrained	6.4		

PRA-11 Pole Road NW – Low Priority

	Acres	Percent	Volume Sand & Gravel
Total of PRA*	244		
Ag zone	244	100.0%	5,000,000
Constrained (outside Ag zone)**	0	0.0%	0
Unconstrained (outside Ag zone)	0	0.0%	0
		Total	5,000,000
Average lot size in unconstrained	N/A		

PRA-12 Pole Road West - Low Priority

	Acres	Percent	Volume Sand & Gravel
Total of PRA*	352		
Ag zone	352	100.0%	2,700,000
Constrained (outside Ag zone)**	0	0.0%	0
Unconstrained (outside Ag zone)	0	0.0%	0
		Total	2,700,000
Average lot size in unconstrained	N/A		

PRA-14 Slide Mountain - Low Priority

	Acres	Percent	Volume Sand & Gravel
Total of PRA*	107		
Ag zone	0	0.0%	0
Constrained (outside Ag zone)**	6	5.6%	796,262
Unconstrained (outside Ag zone)	101	94.4%	13,403,738
		Total	14,200,000
Average lot size in unconstrained	6.8		

* Total acres excludes City, UGA and 5-year wellhead

** Constraints are pipelines, streams, wetlands, buffers, MRL and 10-year wellhead

*** Composed of only one parcel

PRA - 3 R2A, ROS zones

PRA - 4 ROS, UR4, RR1 zones

PRA - 5 RR2, GC, R2A zones

PRA - 6 R2A zone

PRA - 15 RR2, RR3, STC zones

PRA - 16 NC, GC zones

Assumed Sand and Gravel Volumes

	Total Volume	Ag Volume Sand & Gravel	Constrained Volume Sand & Gravel	Unconstrained Volume Sand & Gravel	Unconstrained Percent	Sand Volume Unconstrained	Gravel Volume Unconstrained	% Unconstrained Sand/Gravel Deducted for Quality & availability reasons	Modified ratios of sand:gravel	Sand volume w/ quantity deductions & ratio changes	Gravel volume w/ quantity deductions & ratio changes	Total volume w/quantity deductions & ratio changes
PRA-1(L)	80,100,000	0	35,102,832	44,997,168	56.18%	18,313,454	26,683,714	95%	60%:40%	1,349,915	899,943	2,249,858
PRA-2 (L)	167,000,000	20,067,593	31,355,614	115,576,793	69.21%	115,576,793	0	99%	no	1,155,768	0	1,155,768
PRA-3 (L)	625,200,000	427,462,532	44,143,770	153,593,699	24.57%	153,593,699	0	100%	no	0	0	0
PRA-4 (L)	46,000,000	0	30,249,600	15,750,400	34.24%	15,750,400	0	99%	no	157,504	0	157,504
PRA-5 (L)	1,800,000	1,210,999	218,023	370,978	20.61%	247,319	123,659	80%	no	49,464	24,732	74,196
PRA-6 (H)	75,000,000	74,869,471	130,529	0	0.00%	0	0	0%	no	0	0	0
PRA-7 (H)	19,500,000	14,821,573	3,459,677	1,218,750	6.25%	587,500	631,250	0%	70%:30%	853,125	365,625	1,218,750
PRA-8 (M)	5,400,000	5,400,000	0	0	0.00%	0	0	0%	no	0	0	0
PRA-9 (H)	15,500,000	0	6,529,528	8,970,472	57.87%	3,588,189	5,382,283	40%	70%:30%	3,767,598	2,691,142	6,458,740
PRA-10 (M)	3,800,000	85,154	415,126	3,299,720	86.83%	1,302,521	1,997,199	100%	no	0	0	0
PRA-11 (L)	5,000,000	5,000,000	0	0	0.00%	0	0	0%	no	0	0	0
PRA-12 (L)	2,700,000	2,700,000	0	0	0.00%	0	0	0%	no	0	0	0
PRA-13 (M)	25,900,000	5,283,333	10,533,333	10,083,333	38.93%	4,516,088	5,567,246	75%	no	1,129,022	1,391,811	2,520,833
PRA-14 (L)	14,200,000	0	796,262	13,403,738	94.39%	5,380,374	8,023,364	80%	no	1,076,075	1,604,673	2,680,748
PRA-15 (M)	37,000,000	0	26,957,424	10,042,576	27.14%	4,695,583	5,346,993	20%	no	3,756,466	4,277,594	8,034,061
PRA-16 (M)	63,400,000	45,583,647	4,826,504	12,989,850	20.49%	5,409,023	7,580,827	90%	no	540,902	758,083	1,298,985
Totals	1,187,500,000	602,484,301	194,718,222	390,297,477		328,960,941	61,336,536			13,835,839	12,013,603	25,849,443

Assumptions/Notes:

1. Total Volume is from Report Engineering Geology Evaluation Aggregate Resource Inventory Study Whatcom County, Washington (Geo-Engineers, Sept. 30, 2003, Table B-3).
2. For purposes of the above calculations, it is assumed that the sand and gravel in each Potential Resource Area (PRA) is distributed uniformly throughout the PRA.
3. Volume in the Ag zone is the total volume multiplied by the percentage of the land area of the PRA within the Ag zone.
4. Constrained Volume is the assumed volume located outside of the Ag zone, but within pipeline buffers, stream buffers, wetland buffers, 10-year wellhead protection areas, existing MRLs and higher density zoning districts.
5. Unconstrained Volume is the assumed volume located outside of the Ag zone, pipeline buffers, stream buffers, wetland buffers, 10-year wellhead protection areas, existing MRLs and higher density zoning districts.
6. Sand Volume – Unconstrained is the Unconstrained Volume of sand and gravel multiplied by the percent of sand from the PRA (derived from Table B-3 of Geo-Engineers report).

7. Gravel Volume – Unconstrained is the Unconstrained Volume of sand and gravel multiplied by the percent of gravel from the PRA (derived from Table B-3 of Geo-Engineers report).
8. All volumes are in cubic yards.
9. Sand volume with quality deductions and gravel deductions account for the fact that PRAs are undiscovered hypothetical or undiscovered speculative reserves that do not have adequate data to determine the quality of mineral resources in these PRAs.
10. The percent of Sand/Gravel Deducted for quality/availability reasons was determined by the Surface Mining Advisory Committee on a case by case basis utilizing knowledge of committee members and reviewing County GIS maps showing aerial photos, land division patterns, floodplains and other factors. The committee’s recommendations to make deductions from the “unconstrained” volumes of sand and gravel are based upon the following:

- | | |
|-------|---|
| PRA-1 | 95% deduction because of poor quality and dubious quantity of material in this area that has been thoroughly explored by the industry. |
| PRA-2 | 99% deduction because of development patterns (average parcel size of 5.3 acres in unconstrained areas) and high water table. |
| PRA-3 | 100% deduction because of development patterns (average parcel size 5.2 acres in unconstrained areas) and thorough industry exploration has indicated no viable resource. There is a quality issue (high silt content). This PRA is composed of Sumas Outwash, which generally contains relatively thin, discontinuous layers of sand and gravel. |
| PRA-4 | 99% deduction because of development patterns (average parcel size of 5.7 acres in unconstrained areas) and thorough industry exploration has indicated only sporadic availability of sand (there is a lot of clay in this area). |
| PRA-5 | 80% deduction because of development patterns (average parcel size 6.4 acres in unconstrained areas) and geological uncertainty (this unit shouldn’t have extensive sand and gravel). This PRA is mainly in discontinuous Sumas Outwash with peat deposits. |
| PRA-6 | Not applicable because there is no “unconstrained” sand and gravel. |
| PRA-7 | 0% deduction based upon the knowledge of the committee. |
| PRA-8 | Not applicable because there is no “unconstrained” sand and gravel. |
| PRA-9 | 40% deduction because of housing (average parcel size of 2.5 acres in unconstrained areas) surrounding the area. |

- PRA-10 100% deduction because of existing parcelization (average parcel size of 5.1 acres in unconstrained areas) and dubious quality of the material.
- PRA-11 Not applicable because there is no “unconstrained” sand and gravel.
- PRA-12 Not applicable because there is no “unconstrained” sand and gravel.
- PRA-13 75% deduction because of existing development patterns west of Mission Road and south of existing MRL. The average parcel size is 6.7 acres in unconstrained areas. Much of the resource is on Tribal land.
- PRA-14 80% deduction because of geological uncertainty associated with “undiscovered speculative” classification.
- PRA-15 20% deduction because of dubious nature of the material, although it could be greater due to the geological uncertainty about the quality and quantity of the material. This PRA appears to be composed mainly of Sumas Outwash plus Older stream sediments flanking the modern floodplain of the Nooksack River. These deposits are commonly discontinuous and some contain primary or reworked volcanic mudflow material.
- PRA-16 90% deduction because of development patterns (average parcel size of 4.7 acres in unconstrained areas) and existence of the floodway and floodplain.

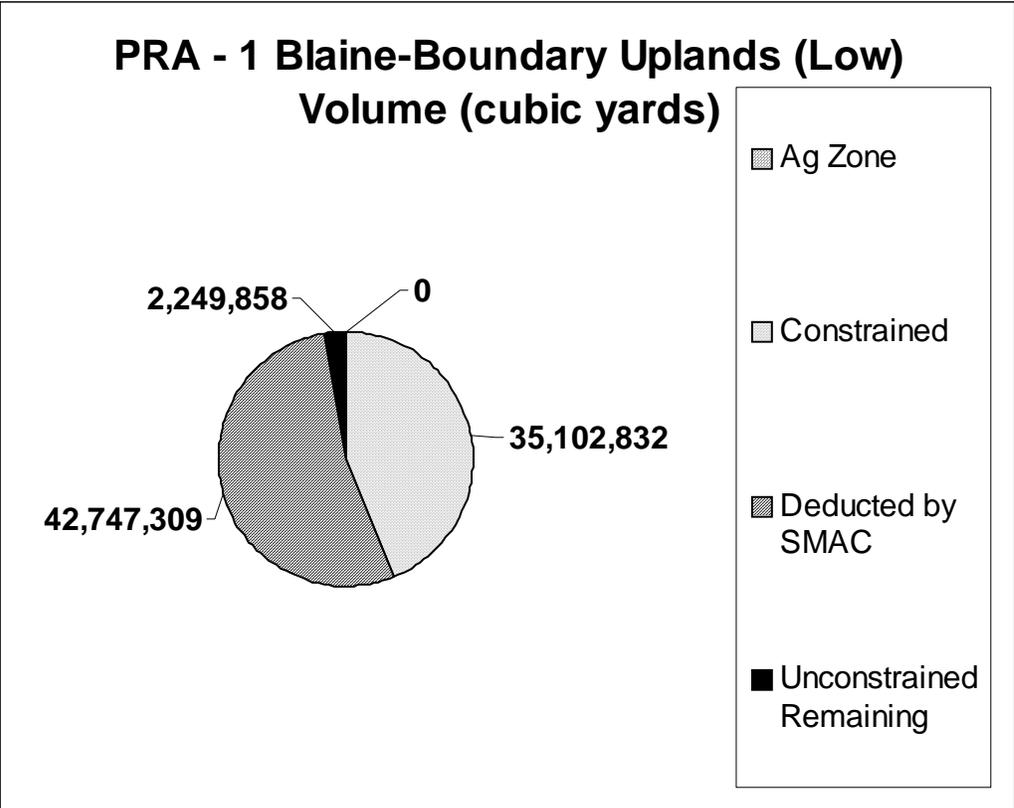
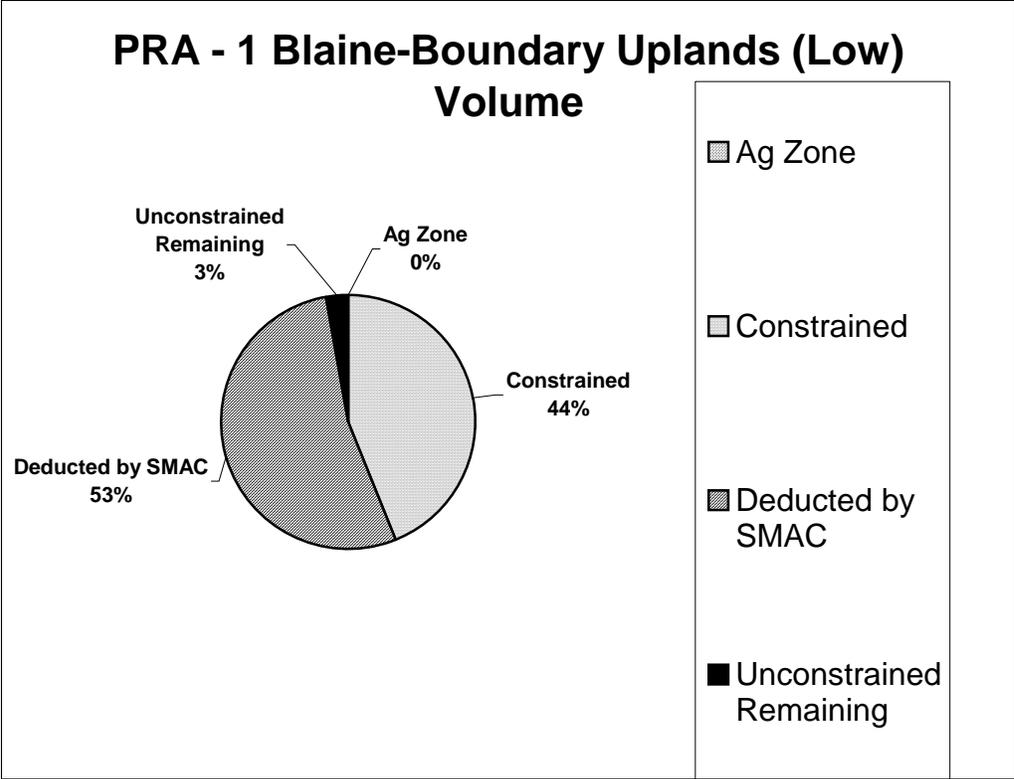
11. Modified ratios of sand:gravel are based upon knowledge of Surface Mining Advisory Committee members.

**Assumed Unconstrained
Volume of Sand & Gravel by Probability Level
with SMAC Deductions & Modifications to Sand/Gravel Ratios**

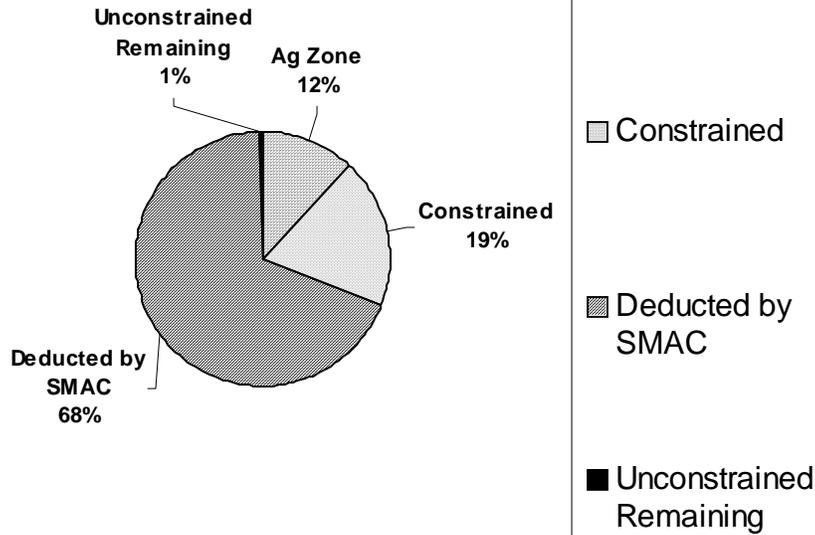
	Sand	Gravel
High Probability PRAs	4,620,723	3,056,767
Medium Probability PRAs	5,426,390	6,427,489
Low Probability PRAs	3,788,725	2,529,348
Total	13,835,839	12,013,603

Notes:

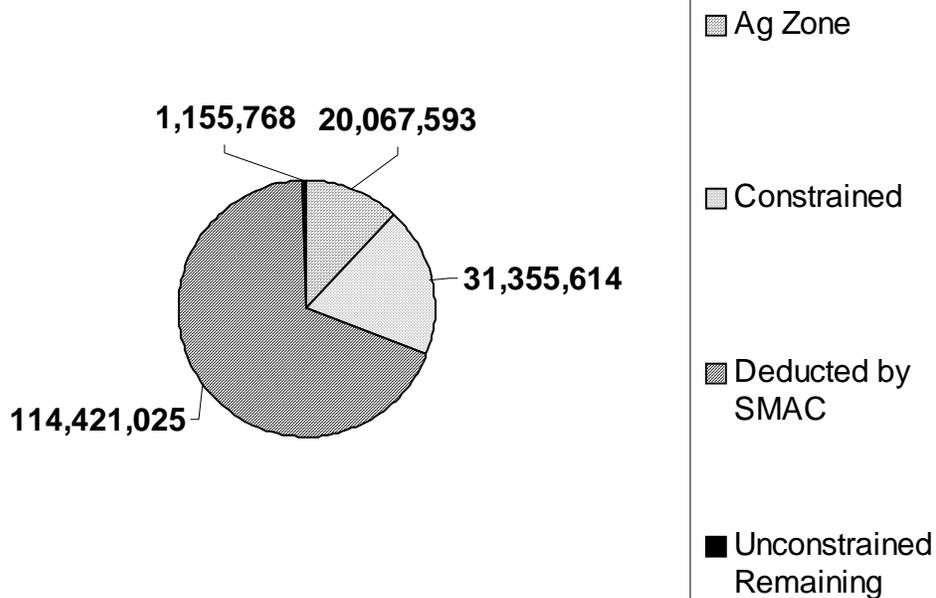
1. High Probability PRAs are considered undiscovered hypothetical reserves (see Geo-Engineers report, pp. 37 & 3).
2. Medium Probability PRAs are considered undiscovered hypothetical or speculative reserves (see Geo-Engineers report, pp. 37 & 3).
3. Low Probability PRAs are considered undiscovered speculative reserves (see Geo-Engineers report, pp. 37 & 3).



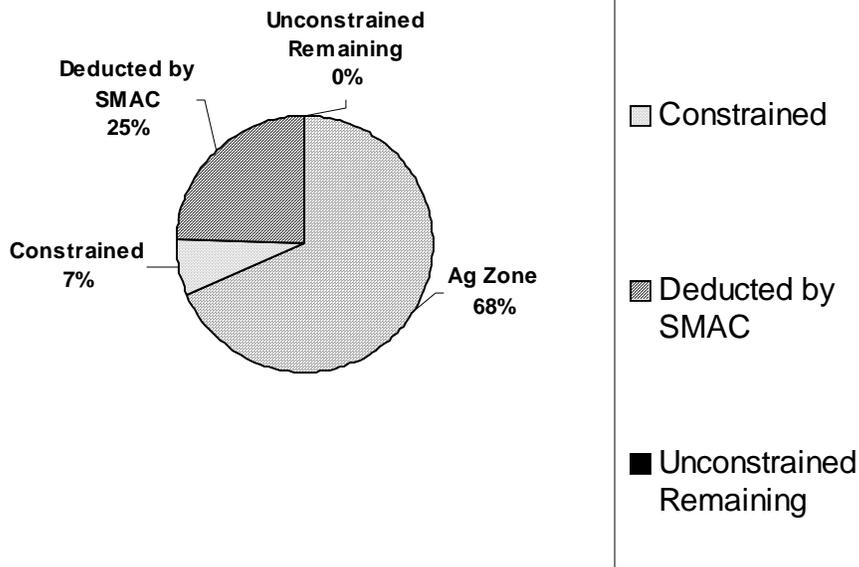
PRA - 2 Grandview (Low) Volume



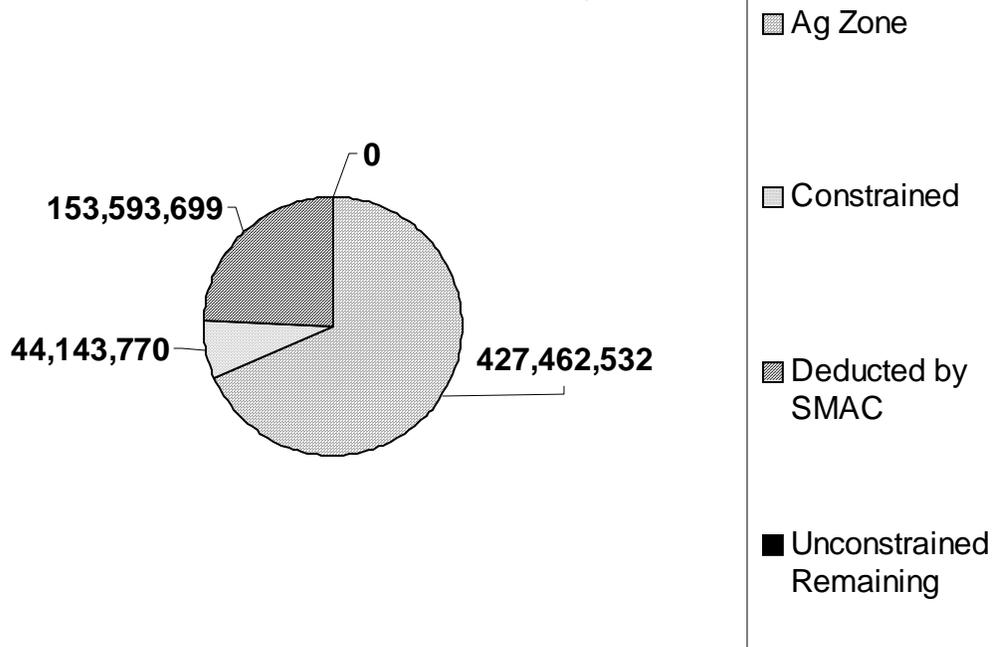
PRA - 2 Grandview (Low) Volume (cubic yards)



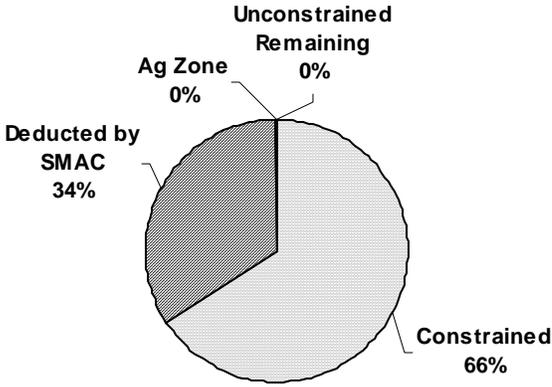
PRA - 3 Dakota Creek-Lynden (Low) Volume



PRA - 3 Dakota Creek-Lynden (Low) Volume (cubic yards)

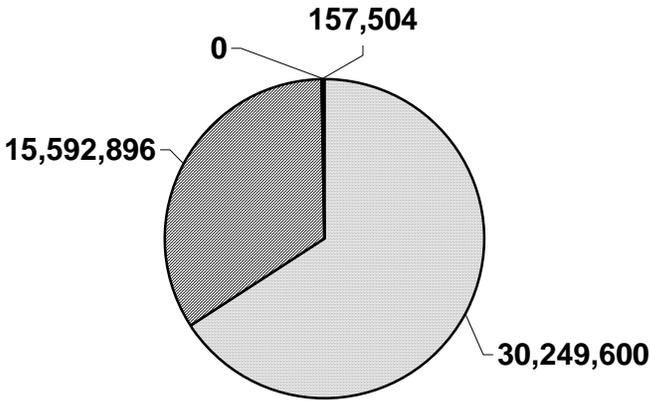


PRA - 4 Smith Road (Low) Volume



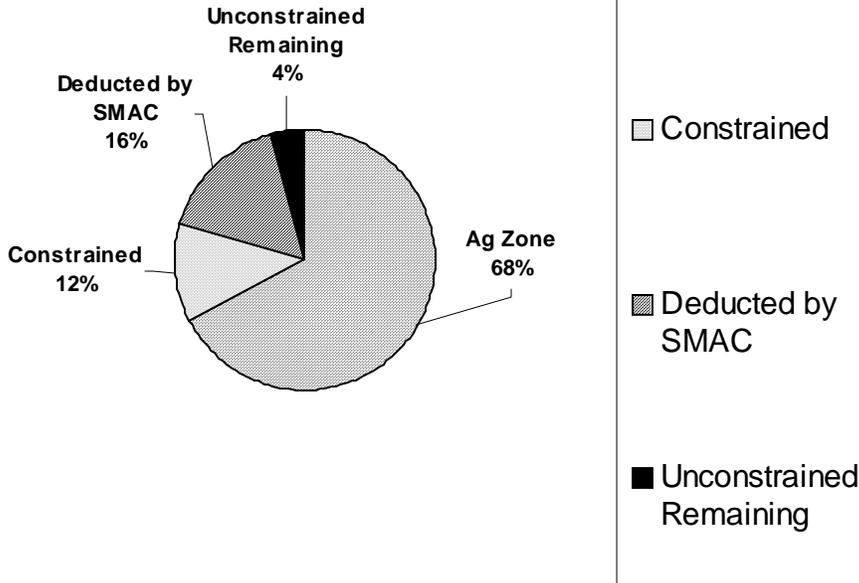
- Ag Zone
- Constrained
- Deducted by SMAC
- Unconstrained Remaining

PRA - 4 Smith Road (Low) Volume (cubic yards)

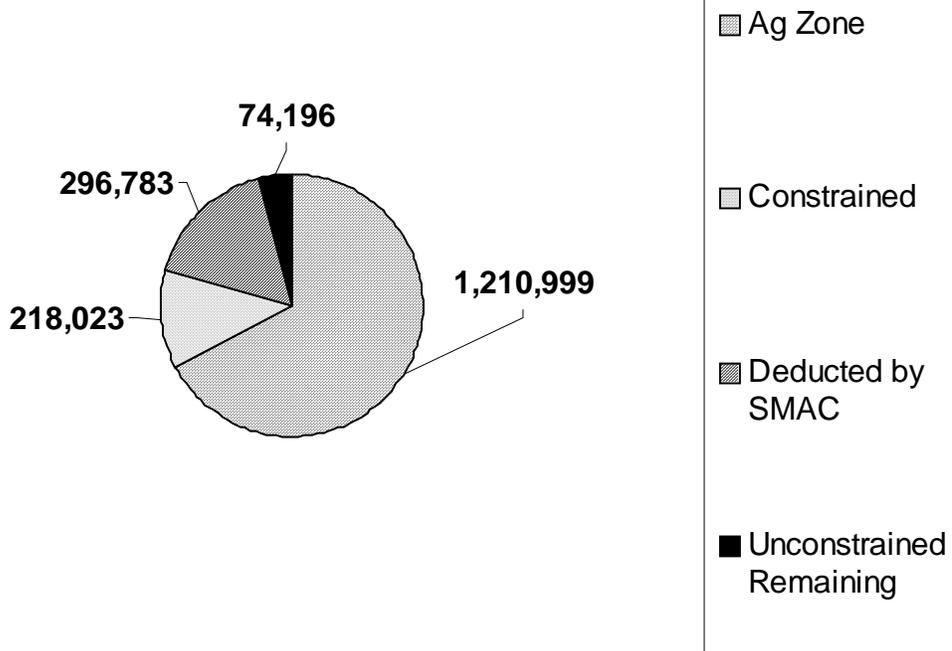


- Ag Zone
- Constrained
- Deducted by SMAC
- Unconstrained Remaining

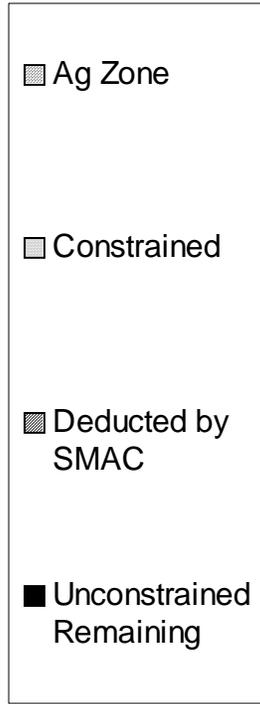
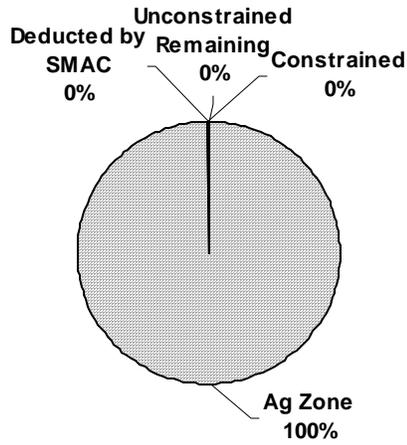
PRA - 5 Wisner Lake (Low) Volume



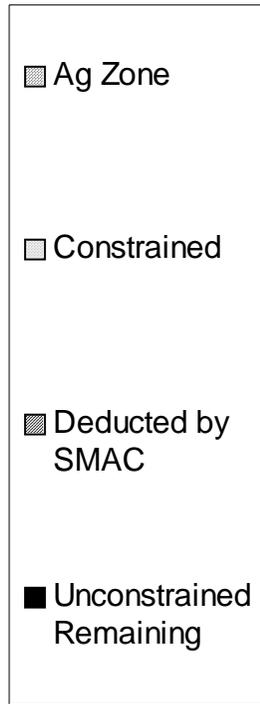
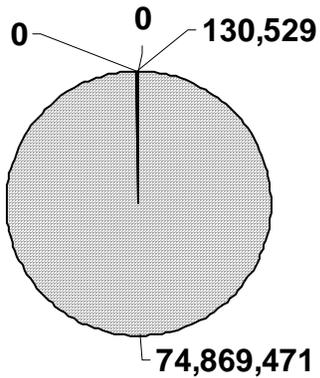
PRA - 5 Wisner Lake (Low) Volume (cubic yards)



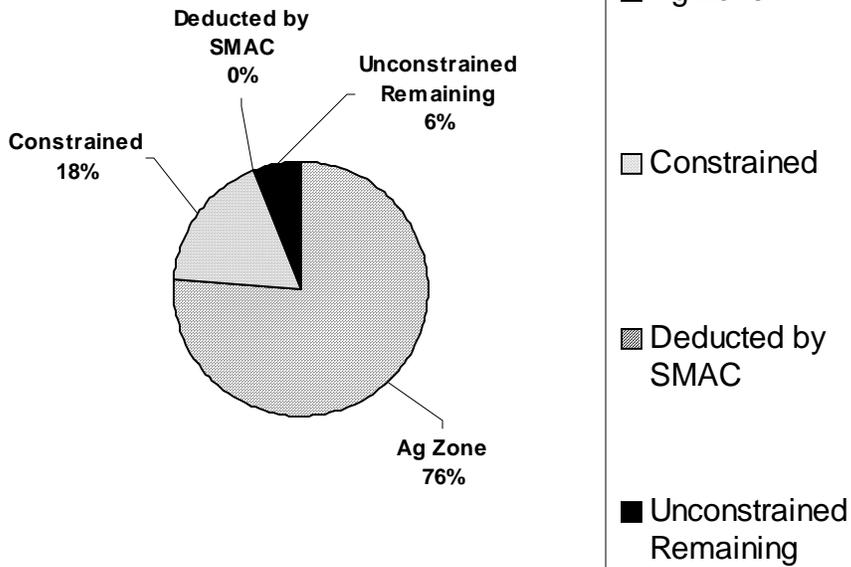
PRA - 6 Judson-Pangborn (High) Volume



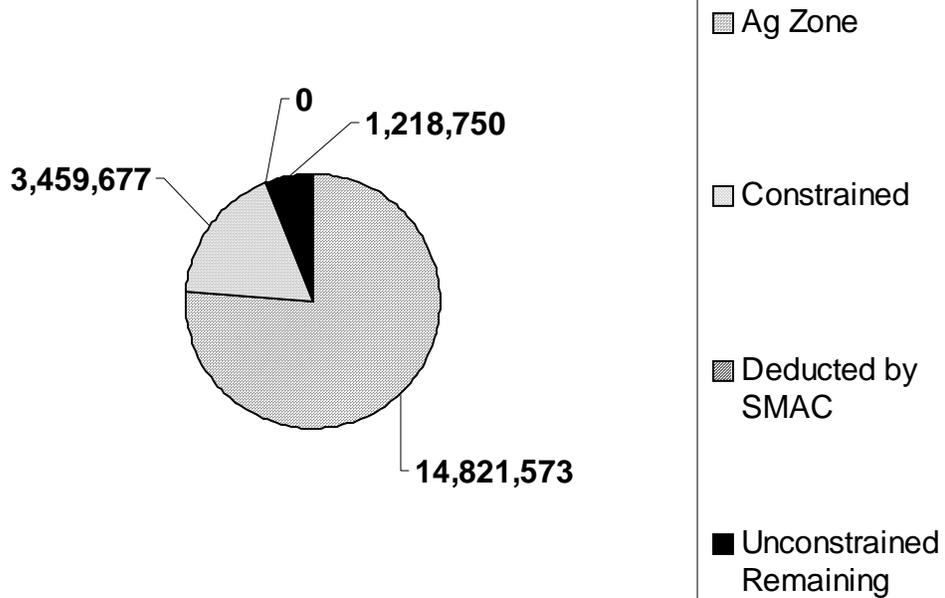
PRA - 6 Judson-Pangborn (High) Volume (cubic yards)



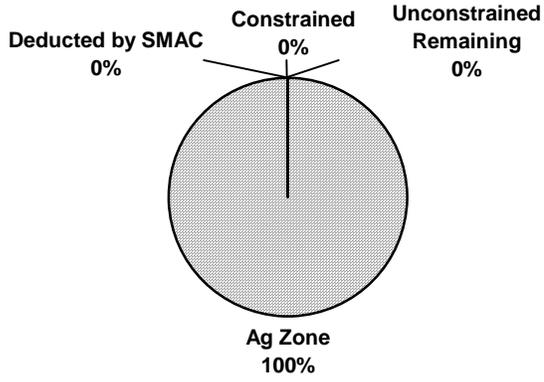
PRA - 7 Trapline - Pangborn (High) Volume



PRA - 7 Trapline - Pangborn (High) Volume (cubic yards)

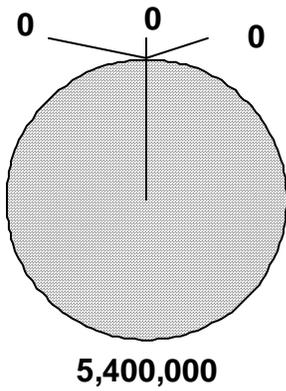


PRA - 8 NE Nooksack (Med) Volume

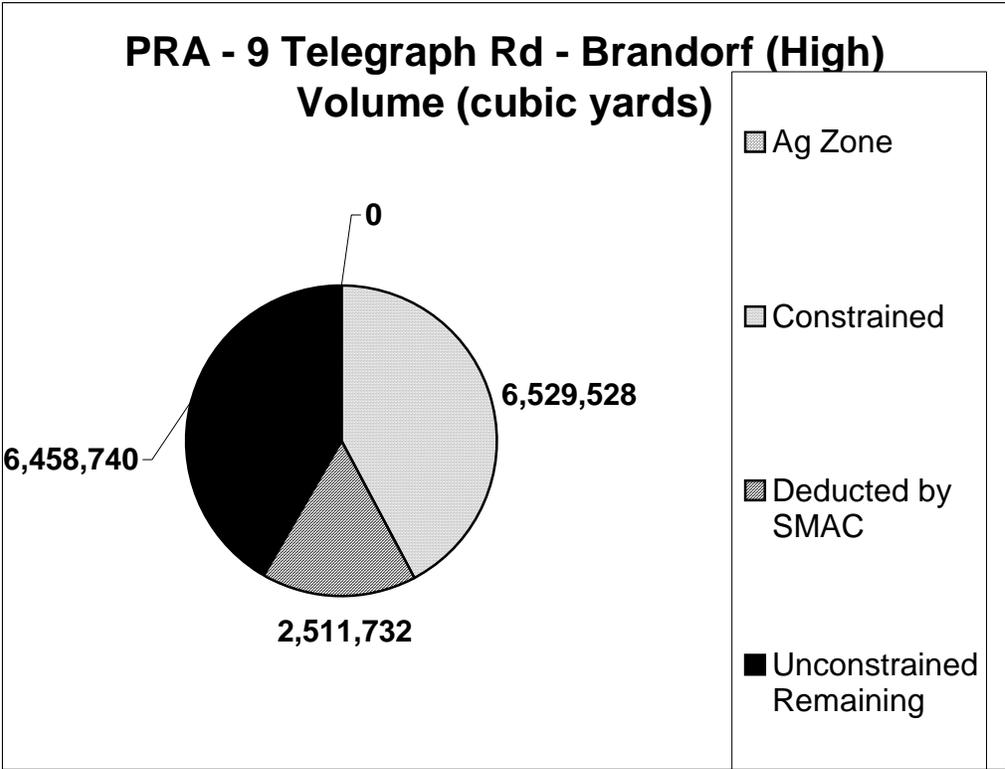
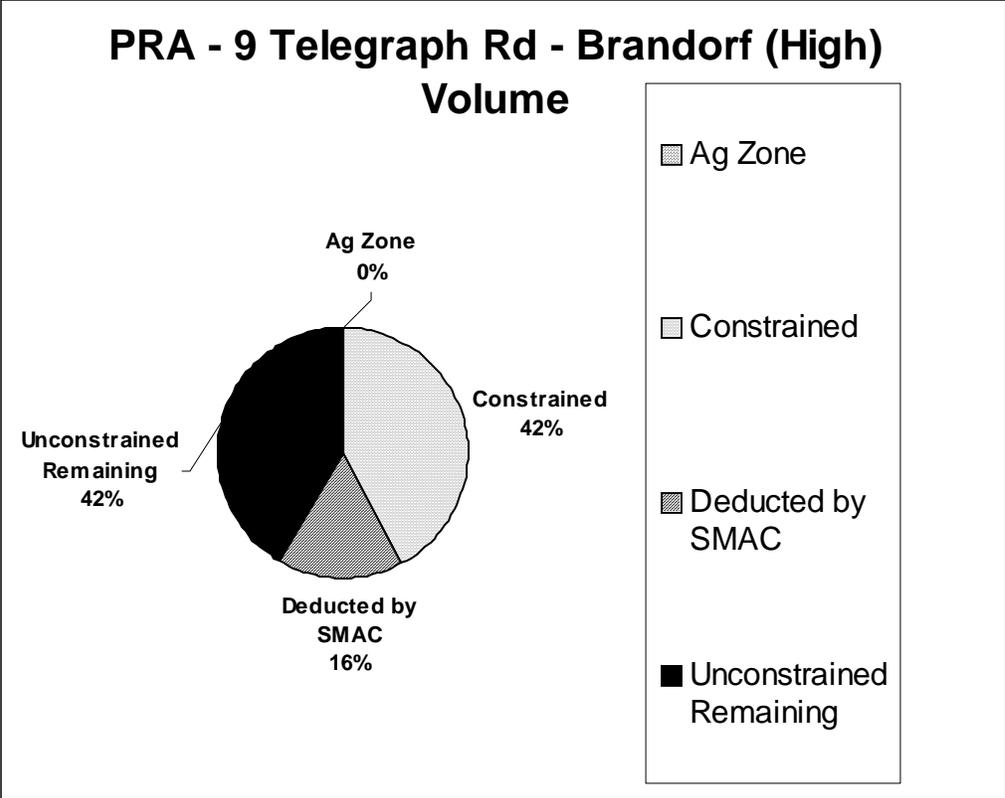


- Ag Zone
- Constrained
- Deducted by SMAC
- Unconstrained Remaining

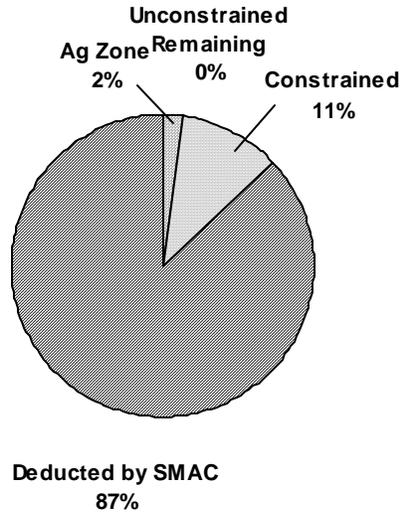
PRA - 8 NE Nooksack (Med) Volume (cubic yards)



- Ag Zone
- Constrained
- Deducted by SMAC
- Unconstrained Remaining

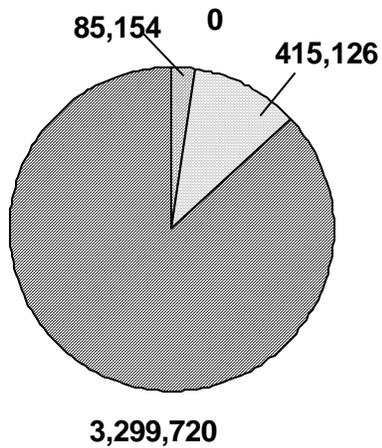


PRA - 10 Carl Road (Med) Volume



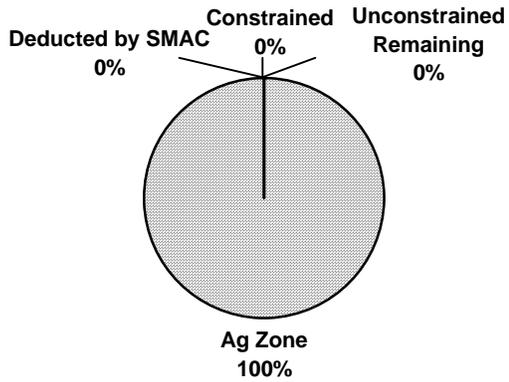
-  Ag Zone
-  Constrained
-  Deducted by SMAC
-  Unconstrained Remaining

PRA - 10 Carl Road (Med) Volume (cubic yards)



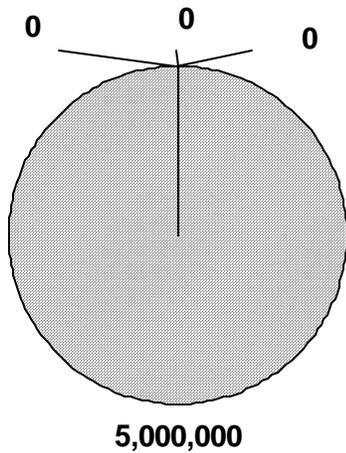
-  Ag Zone
-  Constrained
-  Deducted by SMAC
-  Unconstrained Remaining

PRA - 11 Pole Road NW (Low) Volume



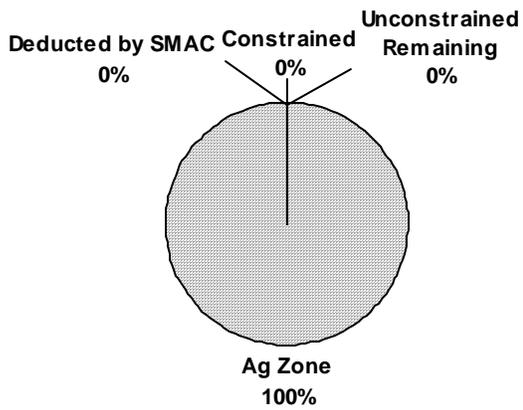
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- Constrained
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- Unconstrained Remaining

PRA - 11 Pole Road NW (Low) Volume (cubic yards)



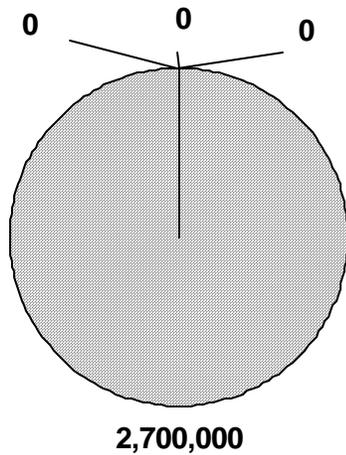
- Ag Zone
- Constrained
- ▨ Deducted by SMAC
- Unconstrained Remaining

PRA - 12 Pole Road West (Low) Volume



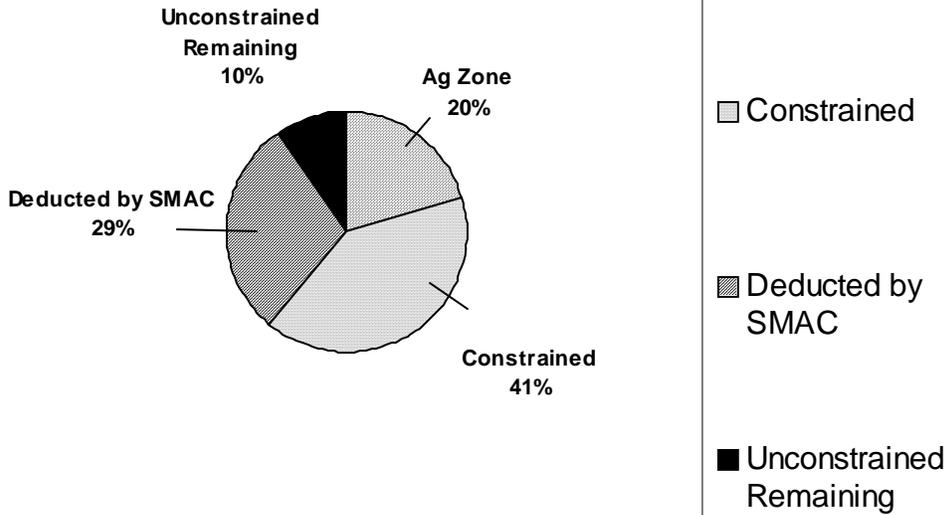
- Ag Zone
- Constrained
- ▨ Deducted by SMAC
- Unconstrained Remaining

PRA - 12 Pole Road West (Low) Volume (cubic yards)

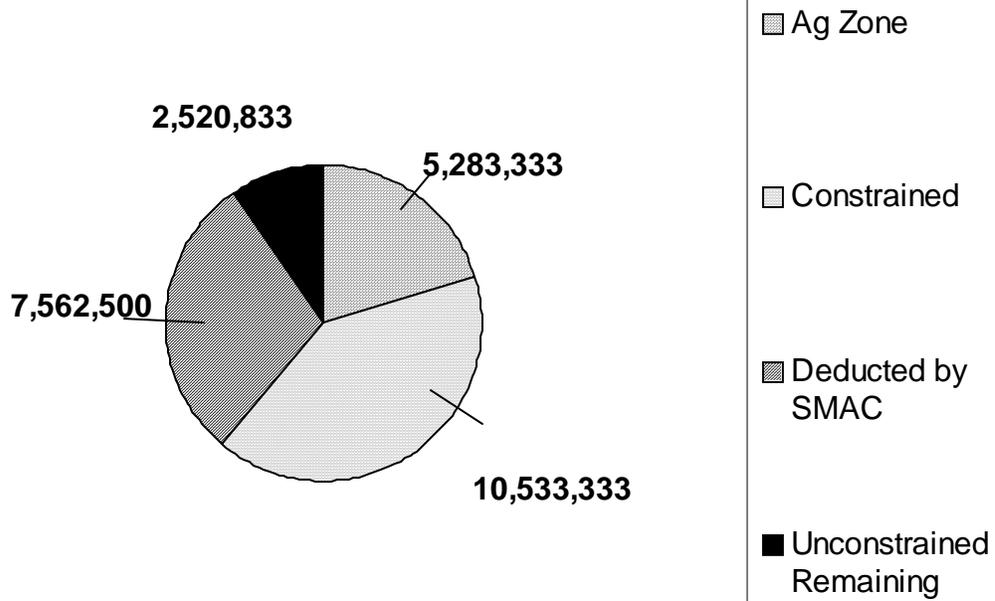


- Ag Zone
- Constrained
- ▨ Deducted by SMAC
- Unconstrained Remaining

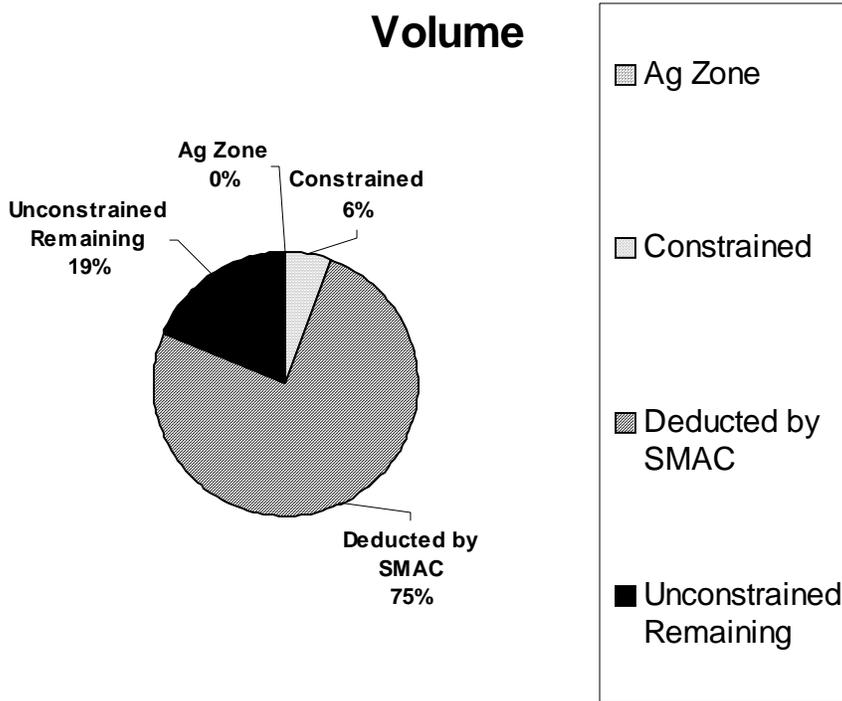
PRA - 13 Pole Road (Med) Volume



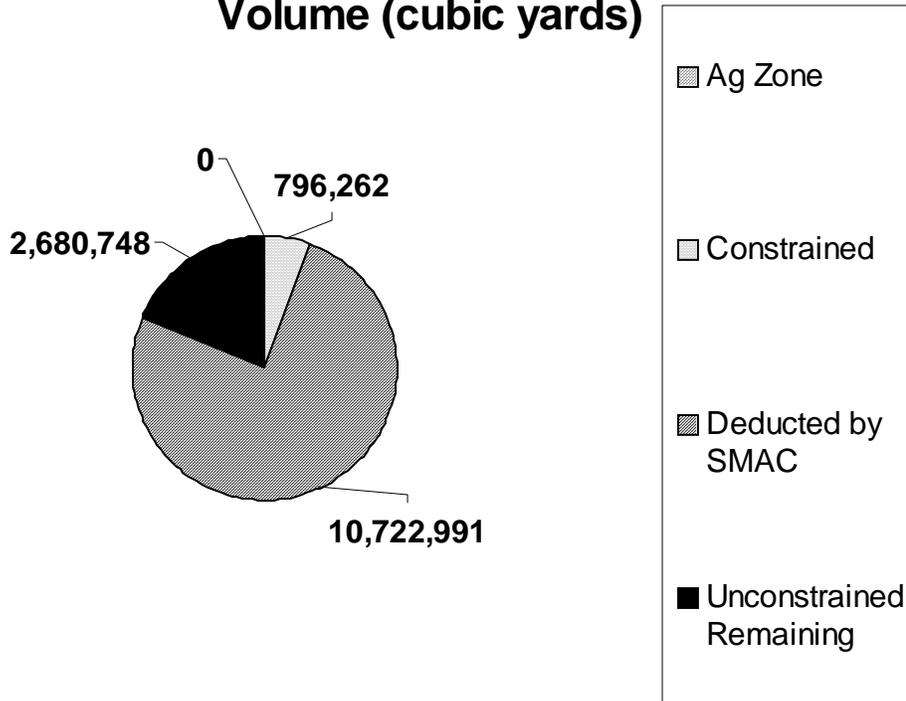
PRA - 13 Pole Road (Med) Volume (cubic yards)



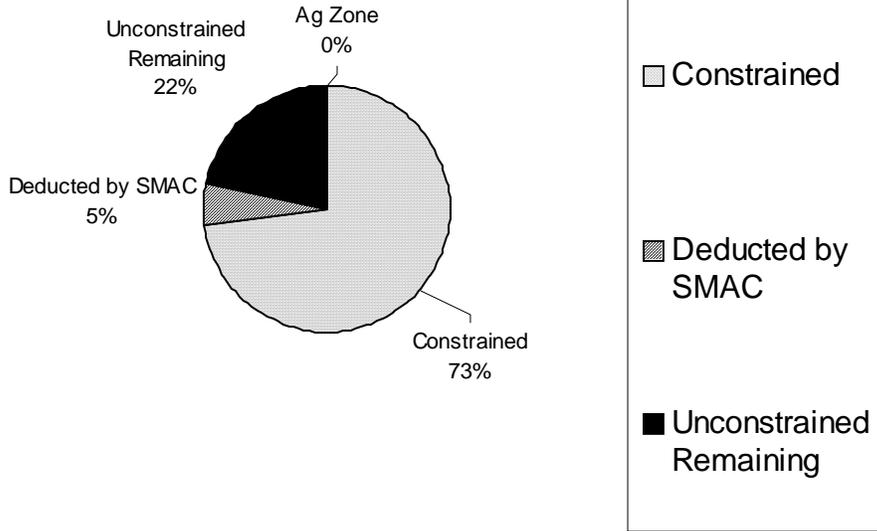
PRA - 14 Slide Mountain (Low) Volume



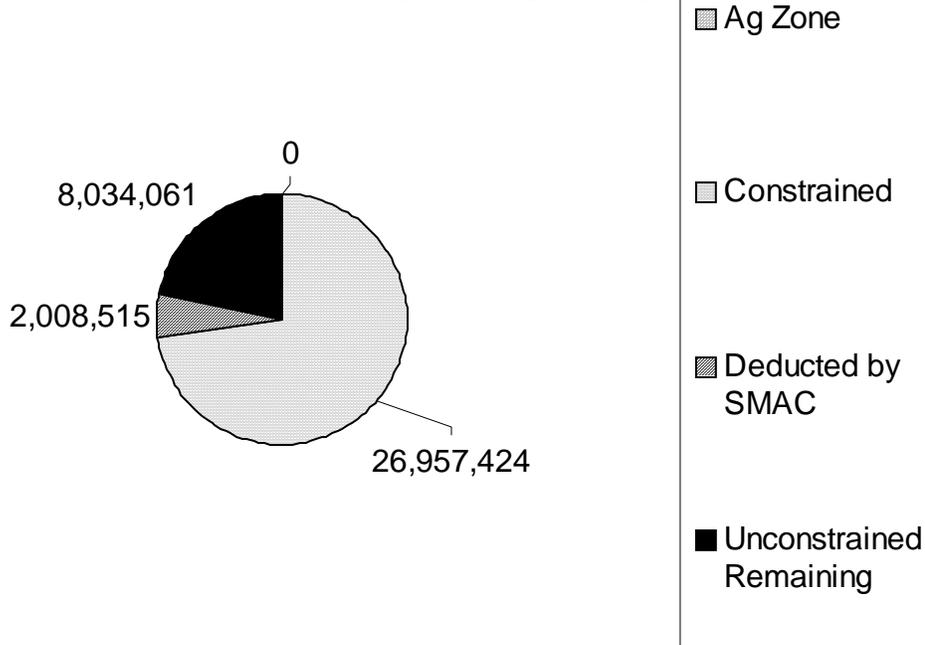
PRA - 14 Slide Mountain (Low) Volume (cubic yards)



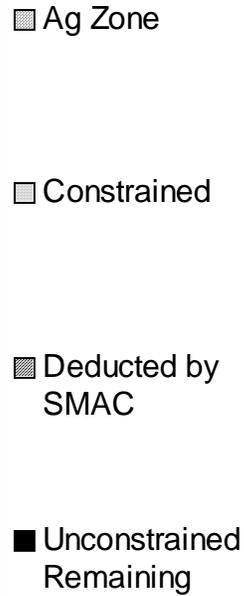
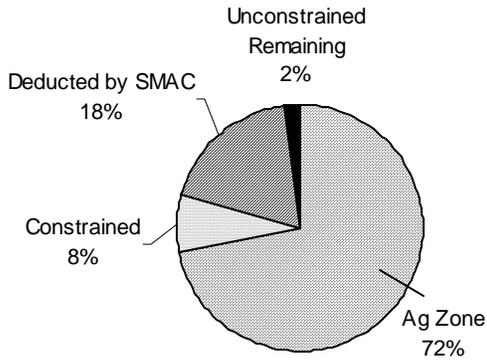
**PRA - 15 S. Kendall-Nooksack R. (Med)
Volume**



**PRA - 15 S. Kendall-Nooksack R. (Med)
Volume (cubic yards)**



**PRA - 16 Deming-Nooksack River
(Med)
Volume**



**PRA - 16 Deming-Nooksack River
(Med)
Volume (cubic yards)**

